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‘Document and go’

A critical realist descriptive explanation of how nurses use vital signs in acute care

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Statement of original authorship

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Abstract

Nurses play a key role in averting adverse outcomes from patient deterioration in hospital wards by responding to changes in vital signs. In Australia, these measurable cues of a patient's health status form the basis of hospital emergency response systems. Serious consequences, such as death or prolonged hospital stays, can result from poor vital sign measurement and recording practices. Missed deterioration remains a problem despite initiatives such as the Adult Deterioration Detection System (ADDS), which ensures that experts other than members of ward staff can be alerted and respond to deteriorations in patients' vital signs. Using a critical realist framework, this study examined factors which influenced nurses' use of vital signs in two busy hospital wards.

A descriptive explanatory design, using sequential qualitative ethnographic methods, was used to collect data from nurses with different levels of experience working in medical and surgical wards. In phase one, fifty hours of observation in the context of hospital wards provided insights into nurses' vital sign practice. In phase two, interviews with twenty registered and enrolled nurses provided in-depth explanations of their vital sign practices. A critical realist explanatory process of abduction and retroduction revealed causal mechanisms which either enhanced or constrained nurses vital sign practices.

This study found that organisational processes, culture and history act upon nurses vital sign practices in two main ways. Firstly, cultural barriers to and enablers of nurses' agency resulted in them circumventing rules. The ADDS was difficult for the nurses to operationalise if it conflicted with their experience and knowledge of a patient. Participants' reflective deliberations about vital sign practices revealed how they struggled to align the individual

complexity of patients with the set parameters of the ADDS. Instead, nurses often privileged other cues when assessing patients, drawing upon clinical experience and their knowledge of usual patient treatment trajectories to navigate organisational and cultural barriers in order to advocate for medical attention. Secondly, nurses had greater agency if they were confident in their assessment, or had specialist education or experience outside of the clinical ward. When rituals and routines dominated in the presence of strongly hierarchical organisational structures, nurses had diminished agency and exhibited poorer vital sign practices, which often resulted in inaction or devolved care.

This thesis shows that vital signs offer an imperfect account of a patient's health status, with vital sign practices, patient variability and organisational structures conflicting with the purely objective measure that ADDS relies on. Though vital signs are recognised as a means of communicating change, their use is dominated by ritual and routine practices. They are used as a tool to navigate cultural practices, which are in turn informed by power dynamics and organisational processes. Structural barriers which have an impact on nurses' assessment of patients and on their resulting actions are a new subject for investigation to develop strategies to address missed patient deterioration. The results have significance for health care organisations, for providers of health professional education and for individuals.

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Acronyms

ACSQHC	Australian Commission on Safety and Quality in Health Care
ADDS	Adult Deterioration Detection System
ADON	Assistant Director of Nursing
BP	Blood pressure
EN	Enrolled Nurse
EWS	Early Warning System
MAPU	Medical Acute Procedure Unit
MET	Medical Emergency Team
NSW	New South Wales
NUM	Nurse Unit Manager
Obs	Observations
QID	Four times daily
RN	Registered Nurse
RRS	Rapid Response System

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Chapter 1 Introduction to the study

> … Her unexplained drop in blood pressure failed to raise the alarm and she was given only hydration treatment with no plan to monitor her more closely, or have the on-call doctor look at her.
>
> "Due to a series of errors and miscommunication, further and more frequent observations were not instituted, resulting in a number of missed opportunities to review her condition," Mr Lock said in findings delivered in Brisbane on Friday.
>
> "This resulted in a failure to recognise signs of emerging septic shock and to institute appropriate and timely treatment which may have changed the adverse outcome."
>
> Several hours after admission Ms Carter-Maher's condition deteriorated and she broke out in a purple rash. She went into cardiac arrest and was unable to be revived [Ms Carter-Maher was 17 years of age].
>
> Coroner's case, accessed September 2015, News.com.au

Making sure that hospitalised patients who deteriorate receive appropriate and timely care is a crucial safety and quality challenge. Over at least two decades there has been considerable attention directed toward improving care that deteriorating patients receive, nonetheless the problem remains. Media reports appear when individuals unexpectedly die in hospital, research illustrates the continuing occurrence of adverse events, and the cost, financially and emotionally, to not only health care, but also the community and the individual, are significant. Nurses' assessment practices add to quality care, however, factors that contribute to their failure to recognise and respond to deterioration remain unresolved. This research responds to the problem of unrecognised or mismanaged patient deterioration by examining and explaining these factors as they relate to nurses vital sign practice.

Despite local, national and international implementation of systems which rely on timely response to changes in vital signs, there is strong evidence that opportunities for early recognition of acute illness continue to be missed and that nurses' vital sign practices contribute to this. Closer attention to a patient's vital signs has the potential to significantly decrease the number of adverse events in Australian hospitals, and nurses are best positioned to identify changes in these signs. Early detection of changes in a patient's condition is linked to nurses' close connection to the delivery of patient care (Odell, Victor et al. 2009), and to their clinical assessment of patient progress (Searle-Leach, Mayo et al. 2010). Nurses, however, are having to respond to increasingly complex demands, driven by technological and medical advances (McGarvey, Chambers et al. 2004, Hendrick et al. 2008), increased incidence of chronic illness, an ageing population resulting in increased acuity in hospital patients, and shorter lengths of hospital stay (AIHW 2016). Other factors such as the changing profile and skill mix of nurses in acute care wards (Chaboyer, Wallis et al. 2008), are also challenging the Australian health care system. The increase in patient acuity accompanied by an overall decrease in length of hospital stays has intensified nurses' work in the acute hospital setting.

Nurses' through their vital sign practices contribute to the detection of clinical deterioration, but cues of physiological change continue to be missed. This is in spite of quality and safety initiatives intended to guide practice, such as the National Consensus Statement released in 2011 by the Australian Commission on Safety and Quality in Health Care and reviewed in 2017. The Statement details agreed practices for recognising and responding to clinical deterioration (ACSQHC 2017). Derived from expert experience and published evidence, these practices include the necessary elements for recognising patients whose condition is deteriorating and responding appropriately. The Statement recommends establishing recognition and response systems with the patient's medical team holding primary responsibility for patient care.

The process for communicating diagnosis and management plans for patient monitoring, and, the systems required for access to appropriate qualified, skilled and experienced staff is included. When a response system is established, the Statement advise that it should be supportive, care being patient focused, and, include regular review of the effectiveness of the response system (ACSQHC 2017). Since 2011, these standards have been linked with hospital accreditation (Martin, Jones et al. 2017).

To support the Consensus Statement, the ACSQHC researched the design and use of patient observation charts where vital signs are recorded (Preece, Horswill et al. 2010). This resulted in the development of the Adult Deterioration Detection System (ADDS). The colour-coded ADDS vital sign chart has an embedded early recognition system, an area for action response requirements, and an area for doctor approved modifiable vital signs for patients with known chronic conditions (Preece, Horswill et al. 2010, Christofidis, Hill et al. 2015). Following the release of the ADDS, health care organisations have since implemented various adaptations of this early warning response system, with colour-coded vital sign charts, to address missed cues of physiological change (Le Lagadec and Dwyer 2017), but the problem of unrecognised or inadequately addressed deterioration continues.

Additional risk management strategies have focused on the provision of educational interventions to improve detection of and response to deterioration, mainly through the use of medium to high fidelity simulations (Connell, Endacott et al. 2016). Regulation of the measurement of vital signs, and attention to the nurse-doctor escalation of care have also been recommended (ACSQHC 2017). The “escalation of care component”, with its embedded early identification and warning system, is reliant upon vital signs, which necessitates the implementation of policies and procedures to provide a safety net for patients on wards who are at risk of becoming acutely unwell.

Education strategies and response systems are presumed to improve communication amongst professionals and to enhance organisational reliability (Hughes 2008, Connell, Endacott et al. 2016). Despite these initiatives, patient deterioration is still sometimes overlooked or mismanaged as the opening quote demonstrates. One aspect of deterioration that has received scant attention is the role of nurses' vital sign practices.

1.1 The story of deterioration

Physiological deterioration can occur at any stage of illness, although there are times when a patient is more vulnerable, such as at the onset of illness, following surgical or medical interventions, or during recovery (Haller, Myles et al. 2008, Frost, Davidson et al. 2010). Failing to identify deterioration through monitoring of patient vital signs is associated with delayed interventions, which may result in poor outcomes, including admission to a higher-acuity care ward due to altered respiratory function or cardiac arrest (Malycha, Bonnici et al. 2017). Suboptimal care of hospitalised patients may result in cardiac arrest, death or unplanned admission to intensive care (Quirke, Coombs, McEldowney 2011). The term suboptimal care, raised by McQuillan, Pilkington et al. (1998), implies poor knowledge regarding the significance of clinical findings from changes in airway, breathing and circulation. Despite antecedents to clinical deterioration being known through the evidence of changes in vital signs (Bleyer, Vidya et al. 2011, Andersen, Kim, Chase et al. 2016), and systems for the early detection of deterioration to access interventions (Churpek, Adhikari, Edelson 2016), suboptimal care of the acutely unwell ward patient still exists (Massey, Aitken, Chaboyer 2008, Quirke, Coombs, McEldowney 2011)

Despite the early warning systems in place (ACSQHC 2017), there are concerns that patient deterioration in hospital wards is not being recognised

or acted upon, and that the implementation of response systems to address physiological changes is not solving the problem (Smith 2010, Massey, Chaboyer et al. 2016). Further, technological developments, economic rationalisation and demographic changes have all altered the way that health care is delivered in Australia (Sinuff, Kahnamoui et al. 2004, Koenig, Demiralp et al. 2015, AIHW 2016). Over the previous decade or so, these changes in health care delivery have increased the demand for hospital beds, as well as episodes of hospital admissions in the private and public health care sectors while overall reducing length of stay. It is predicted that by 2050 the demand for public hospital bed days will have grown faster than the population (Schofield and Earnest 2006), mainly due to an ageing population and to the performance of more invasive and complex interventions (AIHW 2016). All of these factors contribute to increased complexity in hospital wards.

It is important that physiological deterioration is detected and addressed early in the illness trajectory and that it is recognisable through nurses' vital sign practices. In response to the need for early intervention when deterioration has been detected, escalation procedures and access to specialist response teams have been implemented in health care settings. These changes have been made in order to support ward nursing and other medical staff to receive expert help in a timely manner. The interdisciplinary nature of health care requires teamwork and inadequate ward monitoring and responses have been associated with a hierarchical referral culture – whereby patients are referred upward through junior to more senior doctors –, and to a lack of cohesion between doctors' and nurses' work practices (McGaughey, Porter et al. 2017).

With regular monitoring of vital signs, the early indicators of physiological deterioration can be detected in a large proportion of patients at least 48 hours before any potentially adverse event occurs (Elliott, Allen et al. 2015).

In spite of this, vital signs are considered unreliable by some and that there is limited rigorous research showing that a single vital sign parameter can be isolated as an indicator of serious (or worsening) illness (Lockwood, Conroy-Hiller et al. 2004). Also, the optimal thresholds for the response system calling criteria upon which vital signs are based are yet to be defined (CICM 2016).

1.1.1 Cues to physiological deterioration

Objectively measured abnormalities in vital signs, including blood pressure, consciousness, respiration rate, heart rate and oxygen saturations, are common findings prior to serious adverse events such as unplanned admission to critical care, cardiac arrest or death. The importance of objective cues should not be understated. For example, respiratory dysfunction where oxygenation is compromised is a known precursor of adverse events in hospital (Andersen, Kim, Chase et al. 2016), and one which is also known to be associated with reduced chances of survival (Churpek, Adhikari, Edelsen 2016). Respiratory dysfunction, whether an increase or decrease in respiration rate or a reduction in oxygen saturations, can arise from conditions that nurses are commonly exposed to when caring for patients, including pneumonia, systemic infection, hypovolaemia or various pre-existing medical conditions. Studies have established that many of these events are preceded by warning signs in the form of physiological instability; tachypnoea (increased respiration), tachycardia (increased heart rate), hypotension (reduced blood pressure), decreased oxygen saturation (of blood) and changes in consciousness (Harrison, Jacques et al. 2005, Jacques, Harrison et al. 2006, Churpek, Adhikari, Edelson 2016), for example.

Vital signs vary with age, sex, weight, fitness, environment, and medical conditions, among other factors, so no consensus has been achieved as to what levels are normal or abnormal (Hong, Earnest et al. 2013), making vital

signs unreliable in isolation as objective parameters. Vital signs rather than being static, fluctuate due to 'transient perturbations' such as anxiety, coughing, pain and medications, for example, as well as due to natural physiological changeability (Reisner, Chen et al. 2012, p.533.e2). Also, when a patient's physiological condition changes, vital signs do not deteriorate with it in a linear fashion, and patients with normal vital signs may in fact require urgent attention (DeVita, Smith et al. 2010, Henning, Oedorf et al. 2015).

Early warning response systems are based on predetermined criteria used to identify patients at risk of deterioration. Research in developing and validating these call criteria has focused on retrospective period-prevalence surveys reviewing medical records for predefined adverse events and evidence of sentinel abnormal physiological variables (Jacques, Harrison et al. 2006). Altered physiology detectable through vital signs, however, may be prevalent in hospitalised patients on any given day and may not progress to deterioration. Those patients that do deteriorate may be identified late, as established rapid response call criteria are based on delayed signs of worsening clinical condition (Harrison, Jacques et al. 2006). Vital signs may also be fallible and difficult to interpret (see Table 1 below), which may lead nurses to rely on other cues.

Subjective criteria such as skin colour changes or that the patient states they feel unwell are also commonly used by doctors and nurses to detect physiological changes (Santiano, Young et al. 2009). However, subjective cues are not explicitly included in early warning response systems and may be devalued in favour of more objective data like those gathered through vital sign monitoring. The physiological cues most commonly associated with deterioration relate to changes in breathing, oxygenation and blood pressure, though, as previously noted, these cues may be unreliable, and thus cues subjectively noticed by nurses may take precedence.

Table 1 Limitations of vital signs

Parameter	Issues	Author(s)
Respiration	Respirations are the first vital sign to show variance yet measured in only 1/5th of all sets of vital signs.	Cretikos et al (2008), Mitchell and Van Leuvan, (2008)
	Respiratory rate is often estimated rather than physically counted	Philip et al. (2013), Philip et al. (2015)
Pulse oximetry (oxygen saturations)	Low oxygen saturations are associated with the highest 30 day mortality rate	Hong et al. (2013)
	Nurses knowledge around the use of pulse oximetry and their understanding of the physiological values obtained is problematic	Kiekkas et al. (2012), Elliott et al. (2006), Considine (2005a)
Pulse/Heart rate	Tachycardia (>100bpm) is unreliable as an indicator of fluid loss.	Yeh and Velmahos (2012)
	Bradycardia was present in hypotensive trauma patients	Ley et al. (2009)
	Cardiac irregularity increasing due to ageing population and higher rates of obesity	Miyasaka et al. (2006)
	Pulse not palpated by nurses	Maddoc-Sutton et al. (2009)
Blood pressure	Prolonged hypotension is associated with a poor outcome	Leone et al. (2015)
	Blood pressure alone not a reliable predictor of clinical outcome, and varies with age, sex, health, race, ethnicity	Hong et al. (2013), Ferns (2010)
	Mean arterial pressure a more reliable indicator of organ perfusion, however is underrepresented in the literature	Leone et al. (2015), Bradshaw (2012)
Temperature	Temperature is a measurement frequently taken by the least experienced nurses	Evans and Kenkre (2006)
	Sepsis a leading cause of death and intensive care admission includes fever as a criterion	Lopez-Bushnell et al. (2014)
Age related changes	Vital signs more accurately reflect changes in non-elderly patients (<65 years) than elderly (65 or older)	Churpek et al. (2015)

1.1.2 Nurses' role in detecting physiological deterioration

Providing an umbrella of protection over acute care hospital wards involves the surveillance and timely and appropriate management of patients who are at risk of adverse physiological change. Nurses are ideally situated to detect physiological change by taking and recording vital signs obtained during nursing care. They are also optimally positioned to act upon vital sign abnormality. The early recognition and correction of physiological abnormalities can improve patient outcomes by reducing the incidence of adverse events, making nurses' ability to identify, interpret and act on physiological abnormality a fundamental factor in the prediction and prevention of such events (Considine and Botti 2004). However despite patients' fulfilling the criteria for calling the rapid response team, nursing staff do not always identify abnormalities in vital signs and/or activate the system (Hillman, Chen et al. 2005).

Nurses perform a myriad of interventions which are either nurse-initiated or prescribed by other providers (Jones, Hamilton et al. 2015); indeed there are few processes in hospitals that do not involve nurses. Nurses have the most contact with patients in the clinical setting and would therefore appear to be the most likely people to notice a deterioration or other change in a patient's condition. Research has shown that adverse events tend to be preceded by observable physiological abnormalities by up to eight hours, including changes in blood pressure, pulse and respiration rate, and oxygen saturations (Schein, Hasday et al. 1990, Hillman, Bristow et al. 2001, Cuthbertson, Boroujerdi et al. 2007, Galhotra, DeVita et al. 2007, De Vita, Smith et al. 2010). It is not clear from the research why these cues are missed by nurses as often as they are.

What counts as an application of a patient monitoring system, which includes physiological observations and vital sign monitoring outside of critical care areas, has, until recently, been poorly defined in the literature. Monitoring outside intensive care units' was defined by a consensus conference of international experts on identifying when the hospitalised patient is in crisis as; the 'ongoing assessment of a patient with the intention of detecting abnormality and triggering a response if an abnormality is detected' (De Vita, Smith et al. 2010, p.376). Detection of and acting upon alterations in the condition of a patient relies on the integration of vital sign tracking, assessing of a patient and recording findings, and, on monitoring at regular intervals.

Despite their importance as possible predictors of deterioration, vital signs are not always measured, recorded or acted upon (Hillman, Chen et al. 2005, Fuhrmann, Lippert et al. 2008). A retrospective audit of the medical records of 211 adult patients in five Australian hospitals following major surgery, revealed that only 17 per cent of medical records had complete documentation of vital signs and of the associated medical and nursing review. Respiration rate was the most commonly undocumented vital sign (McGain, Cretikos et al. 2008) despite it being one of the criteria for activating the rapid response system in the hospitals studied.

The reasons for failure to detect and respond to changes in vital signs vary, and may be linked to low staffing levels, inexperience, and timing. Staff availability and nurse-to-patient ratios may be lower in the acute care areas of hospitals outside of regular hours. There may be insufficient time for the hand-over of care and for regular patient assessments, which would include measurement and recording of vital signs (Sundarajan, Flabouris et al. 2016). Also, there may be fewer or inexperienced staff caring for patients with complex needs, and they may lack the confidence or the capabilities to care for these patients safely and effectively (McQuillan, Pilkington et al. 1998).

Each of these factors may expose patients to unplanned admission to critical care, or to extended stays in hospital.

It has been suggested that acutely ill patients on the acute care wards are also more vulnerable to physiological deterioration at times when staffing levels are at their lowest, or following after-hours discharge from intensive care. This equates in hospital settings, to periods between 1700 and 0700 and on weekends (Goldfrad and Rowan 2000, Pilcher, Duke et al. 2007, Santamaria 2007, Peberdy, Ornato et al. 2008). The circadian pattern of rapid response system activation was explored in a retrospective observational study over a four month period in one Australian hospital with the finding that 53 per cent of calls (n2,568) occurred in the period between 1800 and 0800 (Jones, Bates et al. 2005). The time of discharge from critical care areas to hospital wards also affects mortality. Patients discharged from intensive care out of hours were 1.33 times more likely to die (Goldfrad and Rowan 2000). Similarly, Pilcher et al. (2007) found that patients discharged to hospital wards from intensive care out of hours were 1.42 times more likely to die than patients discharged during the day.

While the reasons behind these negative patient outcomes from unexpected deterioration are unclear and most likely multifactorial (Peberdy, Ornato et al. 2008), evidence suggests that reduced senior staffing in hospital wards after hours leads to delayed detection of patients at risk of physiological deterioration (Santamaria 2007) but not increased mortality (Santamaria, Duke et al. 2015). The increase in patient acuity affects clinical practice in a number of ways. Firstly, clinical staff may not have the knowledge and skills to safely identify acutely ill ward patients at risk of deterioration (Quirke, Coombs, McEldowney 2011, Chen, Hillman et al. 2009, Massey, Chaboyer, Anderson 2017). Secondly, clinical staff may lack the knowledge and skills to safely care for these patients (Massey, Chaboyer, Anderson 2017). Thirdly,

major adverse events, including; cardiopulmonary arrest, unplanned admission to critical care areas, and death, occur more frequently in acutely ill ward patients (NCEPOD 2005). Early detection of and response to altered physiology may improve patient outcomes and avoid intensive care admission.

Approaches to improving patient safety in the area of physiological deterioration has more recently focused on implementing standardised systems (Martin, Jones et al. 2017), generating organisational rules and developing operating procedures, such as early warning or rapid response systems. Each of these processes is underpinned by a 'measure and manage' approach which may ignore the complexities of health care delivery (Rowley and Waring 2011). This is in spite of health care organisations being characterised as complex socio-technical systems with increasing patient acuity and technical complexity, which are dependent on human beings to execute care (Kohn, Corrigan et al. 2000). It is important that the central role of the nurse in such systems be considered.

Timely access to appropriate interventions is crucial to reducing the morbidity and mortality of acutely ill patients. It is imperative that patient management in the ward setting is optimised by the early identification of clinical deterioration. Measurement and recording of vital signs as a process for ongoing monitoring of patient progress, as well as for detection of potential complications, are considered an integral component of nursing. As previously noted, nurses are integral to the success of a system associated with physiological deterioration. However, nurses appear to be resistant to these systems, and there is a lack of literature explaining the reasons behind this (Missen, Porter et al. 2017). The function, relevance and efficacy of this aspect of nursing practice has undergone some degree of scrutiny (Zeitz and

McCutcheon 2003), and yet it remains one of the key subjects requiring further research on the matter of under-reporting physiological deterioration.

1.1.3 Introducing a system of safety

Many studies have revealed widespread deficiencies in the acquisition of and actions upon abnormal vital signs in the prevention of adverse events such as unplanned admission to intensive care, cardiopulmonary arrest, or death (De Vita, Smith et al. 2010). This is in part due to reports indicating that approximately 5 – 15 per cent of patients admitted to hospitals experience an adverse event. Moreover, of these, 37 – 52 per cent were considered preventable (Touraangeou, Cranley et al. 2006). In response to this clinical problem, a number of patient safety systems have been developed and implemented. The best known internationally is a rapid response system (RRS) which relies on the measurement of respiration, oxygen saturations, pulse, blood pressure and temperature, as well as, of response to changes in physiology. The RRS is a patient safety initiative aimed at improving the care and management of acutely ill ward patients at risk of clinical deterioration (Gao, McDonnell et al. 2007). The key aims of the RRS are to avert admission to critical care units, facilitate discharge from a critical care facility, and to share critical care skills throughout the hospital (Gao, McDonnell et al. 2007). The RRS requires identification of physiological instability, which is intrinsically linked to patient vital signs (Evans, Hodgkinson et al. 2001, De Meester, Van Bogaert et al. 2013).

As there is evidence that the onset of acute change may be predictable by the exhibition of abnormal physiological signs, measurement of these signs has been embedded in early warning systems to narrow the gap between the identification and management processes. Recognising the range of potentially preventable adverse events that could harm patients, extend their

length of stay and increase costs, health services and government bodies are increasingly treating the improvement of patient safety as a priority global health issue. Safety in this context, is an active construct, and entails more than avoidance of risk or management of error; instead it is characterised by the ability to anticipate and control for unexpected events (Rochlin 2003).

The Medical Emergency Team (MET) developed at the Liverpool Hospital in New South Wales, Australia, is one example of a rapid response system designed to anticipate and control unexpected events, and variations are now utilised across a number of Australian health care agencies (Braithwaite, DeVita et al. 2004). The MET uses nurses and doctors from critical care or emergency wards to respond to ward staff when changes in single vital sign parameters are detected, such as a reduction in blood pressure, altered pulse or changes in breathing (see Table 2 below).

Table 2 Liverpool Hospital MET calling criteria (Hourihan, Bishop et al. 1995)

Acute changes in	**Vital signs**
Airway	Threatened
Breathing	All respiratory arrests
	Respiratory rate <5
	Respiratory rate >36
Circulation	All cardiac arrests
	Pulse rate <40
	Pulse rate >140
	Systolic blood pressure <90
Neurology	Sudden fall in level of consciousness (fall in Glasgow Coma Score of >2 points
	Repeated or prolonged seizures
Other	Any patient who does not fit the criteria above who you are seriously worried about

The MET concept is based on three components: first, criteria defining an at-risk patient, such as through changes in vital signs; second, a response, comprising staff with appropriate skills, knowledge and experience, and; third, ways of monitoring the established system (Hillman 2008). The goal of this final component is to optimise the use of limited resources by identifying patients early, potentially avoiding admission to critical care areas and consequently reducing length of stay in hospital. The medical emergency team is defined as:

> A team, usually consisting of specially trained medical practitioners and specialist nurses, which possesses the required skills and equipment to provide a patient with immediate on-site stabilisation and management, and to start discussions on appropriate limitations to medical intervention if indicated (for example, implementation of a 'Do not attempt to resuscitate' or 'Not for resuscitation' order) (AIHW 2015).

One major drawback of a structured system such as the MET in responding to deterioration is that it is designed only as a referral system (McCallum, Duffy et al. 2013), which does not support decision making by nurses to do anything other than refer. Additionally, the MET response is based upon changes in a single vital sign, which does not necessarily reflect the nuanced, complex picture, presented at the bedside of a patient. Nurses may, therefore, be using other assessment skills beyond vital signs to inform their decisions, because making decisions about changes in the status of a patient requires identification, interpretation and integration of a variety of information (Odell 2010).

In 2008, the Australian Commission on Safety and Quality in Health Care (ACSQHC), finding that the problem of unrecognised deterioration continued, recommended hospitals adopt a coordinated approach in establishing a system for recognising and addressing patient deterioration. The recommendations also included reviewing observation chart design, a minimum standard for recording vital signs, and establishment of an early

warning system. An escalation process, including who to call and when was advised, and, finally, provision to all clinical staff of education on how to recognise the deteriorating patient. The ACSQHC suggested that the introduction of an EWS would be especially useful for junior nursing and medical staff who may not have the skills or knowledge to detect changes suggestive of deterioration (ACSQHC 2008, Mitchell, McKay et al. 2010). Early warning systems (EWS) regardless of their constituent parts, have several functions, which may include either a score or a criteria system, each of which differs in the vital signs measured and in the cut-off points for alerting someone in higher authority (Jacques, Harrison et al. 2006, ACSQHC 2008). An example of an early warning system in Australia is the Adult Deterioration Detection System (ADDS).

The ADDS is a tool for health professionals to detect patient deterioration using a colour coded chart to track changes in vital signs over time (Preece, Horswill et al. 2010). The ADDS integrates both a single parameter MET response criterion, and a multiple parameter colour-coded track and alert system (ACSQHC 2010). The alert system produced by the ACSQHC makes recommendations as to the frequency of vital sign observations and regarding a process for escalation of care (Missen, Porter et al. 2017).

Also to support systems of safety, the ACSQHC published a National Consensus Statement containing ten standards for quality attention. Standard Nine deals with 'Recognising and Responding to Clinical Deterioration in Acute Health Care' (ACSQHC 2012). The Standards draw particular attention to the role that hospitals and health care organisations play in improving patient outcomes. Standard Nine also clarifies the expectations placed on practicing clinicians in relation to vital sign monitoring, reporting and action. However, in spite of these published standards and the organisational

systems in place to guide clinicians, failures to recognise or to address patient deterioration still occur in hospitals.

1.2 The research problem

It is increasingly recognised that nurses are responsible for the early detection of physiological deterioration through everyday practices such as the taking and recording of vital signs (Kisiel and Perkins 2006). It is significant that a rapid response system is not always activated despite a patient fulfilling the criteria for rapid response system activation (Hillman, Chen et al. 2005). The National Patient Safety Agency (NSPA) in the United Kingdom has described ward environments as busy and noisy, with inexperienced and under-skilled nurses and doctors caring for patients with serious complex needs (NPSA 2007). This may be replicated across many Australian health care institutions.

Nurses are central to the assessment of a patient's health status (which includes the taking, recording, interpretation and use of vital signs). Whilst research into nurses' use of vital signs has occurred, and systems have been put in place to ensure sufficient and consistent practice in this regard, under-reporting of physiological deterioration still occurs (Hillman, Chen et al. 2005, Nurmi, Harjola et al. 2005, Fuhrmann, Lippert et al. 2008). What is not well understood are nurses' knowledge, understanding and practices in relation to the monitoring of, use of and response to vital signs in the context of a busy ward environment. In particular, nurses' agency, that is the capacity to act, in relation to organisational and professional factors, which may enable or constrain good vital sign practice.

This study responds to the need to explore and describe how nurses express agency, as well as the factors that relate to vital signs in nursing practice. In addition, nurses' vital sign knowledge, understanding and practices in relation to the monitoring, care and management of patients with changes in their physiology (which may involve life-threatening deterioration), requires attention, as the systems currently in place to address physiological deterioration are inadequate.

1.3 Theoretical perspectives

In developing an explanatory theory, a critical perspective provided a coherent, accountable, theoretical framework to describe acute care nurses' vital sign practices, and, to explore how agency, structure and cultural factors influenced these. Critical realism, as the selected methodology views social reality as the *Empirical*, the *Actual* and the *Real*. The *Empirical* is what human beings experience. The *Actual* is what is possible to happen or does happen, which may or may not be experienced. The *Real* comprises the social and natural objects of the world existing independent of human experience. These objects are themselves comprised of structures and generative mechanisms which may or may not be observed or understood (Bhaskar 1975, Danermark, Ekstrom et al. 2002, Sayer 2007). The aim is to expose the power of hitherto unobserved underlying structures and mechanisms (which may maintain or reproduce an effect) which act as barriers or enablers to nurses' agency.

This study adopted the position, that constructing a causal account of events, is a process to which both theory and data collection contribute in order to understand the emergent properties and features. The knowledge that can be gained by studying nurses' vital sign practices required an ontological approach that captured reality and meanings of these concepts. Ethnographic

methods of observation and interview were selected to explore the nurses' complex socio-cultural setting and their meanings generated in that setting in order to capture and explain their agency.

Agency is defined as the capacity to produce an effect (Nash 1999) and is broadly interpreted as the ability of individuals to perceive their situation, reason about it and consciously monitor their actions. Agency is neither pre-given, nor socially bestowed, but realised practical transactions and relations with our natural, practical and social environment (Archer 2003). Moreover, agency is put forward as an intentional causal intervention which is subject to the possibility of reflexive monitoring (Ratner 2000).

Nurse reflexivity is an important element of this thesis. Nurses' actions are produced through their reflexive deliberation in relation to working with patients and other health professionals. Archer (2003), theorises that, reflexive deliberation is the process whereby agency mediates social structures. The influence of structural factors on the actions of nurses vital sign practices was important to study, as nurses engaged with possible constraints and enablements present in the social and cultural context of hospital wards.

Agency and structure are linked through a series of relationships and are dependent upon each other for existence, and yet they can operate independently of each other (Smith and Madon 2007). There was a need to focus on relationships between structure and agency when discussing nurses' vital sign practices in understanding the influences on this mutually constituted activity.

1.4 Research aim and questions

Vital sign practices performed in complex settings form an integral aspect of recognition and management of patient deterioration. Using a critical realist perspective, the study aimed '*to describe and explain acute care nurses vital sign practices, and, explore how agency, structure and cultural factors influence these'*. This was undertaken by exploring the relationship of nurses to vital signs, and how nurses expressed or subsumed their responses in the context of the complex cultural setting in which practice takes place. Importantly, the generative mechanisms that influenced the measurement and use of vital signs in the setting of complex health care environments were explored.

The utilisation of a critical realist perspective assisted to understand the relationship between agency and structure, and to identify the generative mechanisms that linked the two. This thesis describes how structural powers impinge upon agency, and how nurses use their personal powers to reinforce, challenge or transform the structural impingements. To do this, a two phase sequential qualitative approach was used initially to observe where, how and when nurses used vital signs. Whilst the second phase interviewed nurses to explain why nurses vital sign practices were as they were.

Ethnographic methods of observation and interview (Hansen 2006) were chosen as a way to explore nursing practice in hospital wards. The inclusion of two hospital wards enabled deeper understanding of the influence of context on clinical practice. These two wards were selected as the setting for this research because of the nature of vital sign practice and of complex and fluctuating workloads. Field data collection occurred over a period of three months, which facilitated immersion in and familiarity with the physical spaces of the wards, with the routines of the staff, and the building of rapport

with the nurses. Data collection in this phase involved 50 hours of observations of clinical interactions, including ward rounds, and informal situations such as refreshment breaks and conversations between nurses at the nurses' station. Observation occurred during all three shifts, on weekdays and weekends. Observation data was transcribed into field notes and NVivO v10 was used to share the data with the PhD supervisors for audit purposes.

In the second phase of the study, semi-structured, face to face, individual interviews were undertaken to gain further insights into the practices that had been observed. Participants included registered (Division 1) and enrolled (Division 2) nurses. A diverse sample of experiences and opinions was captured by inviting a range of nurses (from new graduates to nurse managers) from a medical ward and from a surgical ward to participate. Interview audio was digitally recorded, then transcribed for analysis.

Data from each phase was thematically analysed using a process described by Braun and Clarke (2006), then data underwent a process of abstraction and retroduction (Danermark et al. 2002) to generate the conceptual theory. The study contributes to the deteriorating patient literature by offering new insights into agency, structural factors and the generative mechanisms which influence nurses' agency and their vital sign practices.

1.4.1 Research questions

The following questions guided the investigation of acute care nurses vital sign practices.

1. What are nurses' vital sign practices within medical and surgical wards?

2. How do organisational and structural factors influence nurses' vital sign practices?
3. What cultural and structural factors impact on nurses' agency in vital sign practices?

1.5 Structure of the thesis

The thesis is presented in seven chapters. This chapter has provided a background to the study by establishing a broad context for the issue of missed cues of patient deterioration, introducing the research problem and noting its significance to nursing practice. This chapter has also set the scene in terms of nurses' role being recognised as important in the recognition and response to the deteriorating patient. Hospitals have been identified as complex systems, and the national and international safety strategies implemented to address the problem of missed cues have been introduced. These strategies, based on responding to changes in vital signs, appear not to be working, as cues continued to be missed. The quality and safety data used by organisations identifies the problem, and the national health care strategies put in place, but the reasons why nurses and other health professionals miss cues are yet to be fully determined. Critical realism as the research methodology is suggested as appropriate to explore complex socio-cultural settings.

Chapter Two reviews the literature on the relationship between nurses, vital signs and the detection of and response to physiological deterioration. The chapter also discusses the development of response systems that are based on changes in vital signs (which originated in Australia). These systems were later adopted internationally, and though linked to technological advances, have been seen as replacing aspects of nurses' assessments. Vital signs are

presented as unreliable indicators of deterioration, and thus nurses may use alternative means of assessing a patient. Despite the array of literature on nurses' use of vital signs, the importance nurses place on these signs in practice remains poorly understood, with these gaps setting the direction for the thesis' research questions. This chapter highlights the nature of the problem with the existing literature, detailing why response systems were required to address the problem of detecting patient deterioration. Also in this chapter, the role that nurses play in recognising and responding to patient deterioration is detailed, including the reliance upon technology and how this is situated in patient assessment. Organisational and cultural structures that affect nurses' agency are identified as a way of introducing the context of vital sign practices.

Chapter Three details the methods used to gather the data and introduces the participants. The measures adopted to protect the participants and the security of their data are also presented. Following this, the theoretical framework or critical lens used to analyse the data, namely critical realism, is further explained. Ethnographic methods of observation are discussed as a means of capturing nurses' vital sign practices in the context of a medical and surgical ward, as well as the way in which semi-structured interviews with key informants were used to explain these practices. Lastly, the structured process used for data analysis is set out, including how the reliability of the data was assured.

Chapter Four presents the analysis of the observation data, using evidence from the field notes and analytical interpretations, and Chapter Five deals with the second phase of data analysis, the findings from the semi-structured interviews. Excerpts from participants' data support the findings. The data show that nurses are culturally constrained by rituals and routine, some of

which lead to poor vital sign practices, though exemplary vital sign practices are also reported.

In Chapter Six, a critical discussion of the research findings is presented in the context of the existing literature, and addresses the limitations of the study. Generative mechanisms were identified which explain how nurses' vital sign practices were either enhanced or constrained by organisational, cultural and hierarchical structures. The use of the organisationally adopted ADDS recognition and response system, had both positive and negative effects on nurses' vital sign agency, and this had the potential to influence patient outcomes. Nurses' use of reflexive deliberation based on experience with regularly encountered patient situations was shown to place patients at the centre of care.

Finally, Chapter Seven more fully examines the implications of the findings for nursing practice and patient care. It builds upon perspectives discussed in Chapters One and Two, and outlines the contributions of the thesis to practice and policy on identifying and managing acutely ill patients. It provides a critique of the methods used, and discusses the implications of the study for nurse education, policy, practice and future research.

1.6 Conclusion

The significant role that nurses play in the identification of and response to physiological deterioration has been identified as one area of concern in both national and international health care settings. Unrecognised patient deterioration continues to be a problem in health care in spite of systems having been put in place to address the problem. Abnormal vital signs are the trigger for a nursing or medical review, and it is in this area that the nurse's

role is pivotal. Despite their importance as predictors of deterioration, vital signs are not always measured, recorded or acted upon by nurses. Also, there is limited empirical research on the frequency with which vital signs should be measured, even though this frequency can affect identification of at-risk patients. The literature reviewed does not fully explain nurses' responses to changes in vital signs, and therefore in the detection of clinical deterioration, and there is limited research in the area of vital sign practices and how they relate to the role of the nurse. The relationship between physiological changes and subsequent events is the basis of this research.

The next chapter presents the findings of a review of scholarly research, policy documents and standards, guiding the reader through the selected critical research approach and addressing the gaps in knowledge

Chapter 2 Literature review

> … the acutely ill patient has become an object of interest, inquiry, demystification, quantification, surveillance and regulation (Mackintosh and Sandall 2016).

Patients in acute hospital wards are provided with a protective umbrella of safety through careful observation of their condition, accompanied by appropriate and timely interventions if changes occur from stable to acutely unwell. The onset of these changes is often predictable (Chen, Bellomo, Flabouris et al. 2009) , and the measurement of vital signs is important in the 'chain of prevention' (Smith 2010) for diagnosing and/or determining the severity of a patient's illness. This chapter presents the research literature on vital signs and the deteriorating patient in the practice of nursing. The review highlights the significance of the problem and emphasises studies on vital sign use by nurses in their patient assessment and any evidence that supports or refutes these practices. The literature on vital sign validity is also presented, as vital signs underpin systems designed to ensure the quality of recognition of and response to patient deterioration

Given that detectable physiological signs often precede deterioration, systems to identify and respond to at-risk patients have been implemented, but there is insufficient evidence as to their effectiveness. These systems require vital sign measurement to be performed at regular intervals. In addition, a growing body of literature recognises the important role that nurses play in detecting and responding to physiological deterioration, though the relationship remains poorly understood. Although vital signs can signal impending physiological deterioration, little evidence supports the practice of nurses taking vital sign measurements at four- to six-hour

intervals. If nurses detect abnormal vital signs early in a patient's illness trajectory and communicate these changes, physiological deterioration can often be halted or averted.

The literature presented in this chapter was obtained through a database search, a search of grey literature around patient safety in relation to patient care, and studies referenced in the literature gathered from the first two sources. The databases used were Medline (via PubMed and Ovid), Medline Complete, Web of Knowledge, CINAHL, Scopus, ProQuest, ClinicalKey for Nursing, and Cochrane. The search terms were 'acutely ill patient', 'physiological deterioration', 'escalation of care', 'failure to rescue', 'suboptimal care', 'physical assessment', 'health assessment' and 'vital signs'. These search terms captured literature on team, organisational, and contextual factors influencing care for acutely unwell ward patients. Search terms such as 'track and trigger', 'early warning system', 'rapid response system', 'adult deterioration detection system', 'rapid response team', 'medical emergency team' and 'critical care outreach' were used to evaluate the role of safety systems designed to aid the management of acutely ill patients. Specific terms such as 'blood pressure', 'pulse', 'heart rate', 'respirations', 'breathing', 'temperature', 'oxygenation' and 'oxygen saturations', and 'pulse oximetry' were included to localise vital signs to their significance to early warning, rapid response or medical emergency team systems. The search was restricted to publications within the last ten years, apart from seminal literature, as these captured the most up-to-date work on the problem, and to research on adults over the age of 18; seminal works outside this period and demographic were included as background context. No search terms were specifically excluded, however those related to paediatric, neonatal and obstetric situations were considered outside the scope of the research.

In addition to concepts related to the deteriorating patient, the literature from other disciplines such as sociology and psychology was explored. Search terms such as 'decision-making', 'power', 'agency' and 'social responsibility' were used to uncover historical and contemporary material on the cultural and contextual barriers and enablers related to how nurses engage in nursing practice (Reaby 1990, Reaby 1991, Rushforth, Warner et al. 1998, Schroyen, George et al. 2005, Duff, Gardiner et al. 2007, Rushforth 2008, Benin, Borgstrom et al. 2012). Quality and safety literature was also searched to ascertain the link between patient deterioration and adverse events.

In this chapter, the various safety strategies used to enhance organisational resilience and reliability in the care of acutely ill patients are detailed and a review of the evidence regarding their implementation and effectiveness is presented. Empirical evidence is considered, followed by an exploration of the implications for nurses' agency, patient outcomes and organisations when deterioration is missed and why it is missed. Literature examining the agency of nurses with respect to vital signs in the context of organisational policy and power dynamics is also addressed. The literature reviewed shows that acutely ill patients often exhibit abnormal vital signs at least eight to twelve hours before their condition becomes potentially life threatening. This period before acute deterioration provides a window of opportunity for identification and intervention by the nurses who are most closely connected to patient care. The chapter concludes by highlighting gaps and uncertainties in the literature and by considering how a critical stance might usefully help reframe both the nature of the problem and the potential solutions to it.

2.1 Evaluation of the literature

Articles identified in the search were read for thematic content, identification of research methodology, data analysis and recommendations. Common themes were extracted for further exploration and synthesis to ensure methodological rigour (Burns and Grove 2009). The quality of the included studies was ascertained by evaluating their internal validity in terms of potential sources of bias (Conn and Rantz 2003). The inclusion and exclusion criteria for each study and the size of the sample, including the justification, along with the appropriateness of the statistical tests, the philosophical paradigm and the validity or transferability of the outcomes were noted (Denzin and Lincoln 2005). When considering the philosophical literature, the nature of the argument and underlying assumptions were considered in order to identify the discrepancies and challenges in understanding health care (Price and Walker 2009). Search terms were categorised and concepts arising from the search were summarised into themes (see Table 3 and Table 4, below) to produce a coherent and logical narrative. The literature was searched over the life of the study to capture any changes in the theory over time.

The findings from the qualitative literature were, in the main, based on similar populations, though a number relied on retrospective audits of patient records, or on interviews with small sample sizes. Though the sample sizes of these studies were limited, they still provide valuable insights into complex areas, including culture, attitudes, beliefs and subjective clinical judgement. In contrast, the quantitative studies represented larger cohorts of patient groups with variables identified, though few included more than one study site, and most were, again, retrospective in nature.

Table 3 Key items searched

Broad Categories	Search terms	Broad Categories	Search terms	Broad Categories	Search terms
Nursing observations	Vital signs	**Physiological deterioration**	Clinical deterioration*	**Organisational Support**	Risk
	Vital signs AND patient AND deterioration		Patient deterioration*		Workplace support
	Vital signs AND practice		Medical emergency team		Surveillance
	Observations		Adverse event		Supervision AND Clinical
	Patient assessment		Adverse event AND nurse		Clinical support
	Physical assessment		Acute illness		Quality and safety
	Health assessment		Physiological deterioration		Workplace safety
	Monitoring		Early warning system		Suboptimal care
	Trends		Early warning score		Nursing experience
	Observation charts		Rapid response system		Adult deterioration detection system
	Charting	**Communication**	ISBAR	**Agency**	Teamwork
	Nursing charts		SBAR		Human performance factors
	Physiological signs		Teams		Situation awareness
	Heart rate		Packaging		Advocacy
	Pulse				Social responsibility
	Blood pressure				
	Respiratory rate				
	Oxygen saturations				
	Oxygenation				

The following section presents the literature which was organised around central themes (see Table 4 below).

Table 4 Themes arising from the literature

Theme	**Concept**
The acutely ill as an area of interest	• Missed opportunities • Establishing systems to detect and manage • Nurses' health assessment • Other ways of detecting acute illness
The acutely ill as an object for measurement	• Fallibility of vital signs • Adult deterioration detection system • Reliance on technology • Communicating acute illness
The acutely ill and nurses agency	• Organisational culture and contextual factors • Intuition/tacit knowledge • Power dynamics • Communication

2.2 The acutely ill patient as an area of interest

Attention is increasingly being given to the deteriorating patient as an area of interest. Research into the deteriorating patient first emerged in the 1980s, with the early literature emphasising the importance of early identification and intervention before adverse events such as cardiac arrest or unplanned admission to critical care occur. Despite strategies to address this problem, adverse events continue. This first theme from the literature presents the

history of patient deterioration and of the national and international health care systems that have been instigated to address the issue. The role that nurses play, including the role of nurses' health assessments is presented.

The acutely ill patient first came to the attention of researchers through the publication of the seminal work by Schein et al. (1990), who identified that in-hospital cardiac arrests may often be preventable. The authors reviewed 64 cardiac arrest patients' notes for abnormal vital signs or changes in condition in the eight hours prior to cardiac arrest. They found that 84 per cent of the patients had abnormal vital signs or changes in behaviour that were either reported by the patient identifiable in a nursing assessment. Of these, 70 per cent were related to either respiratory function or mental status. Only eight per cent of patients survived to hospital discharge. The authors concluded that efforts to predict and prevent cardiac or respiratory arrest may prove beneficial, and thus were the first researchers to highlight the importance of measurement and analysis of vital signs in averting adverse events – and also to refute the notion that all cardiac arrests were unexpected events (Schein, Hasday et al. 1990).

Findings from the Schein et al. (1990) antecedent study did much to change the common perception that in-hospital cardiac arrest is a sudden and unpredictable event and that it may instead be possible to develop clinical strategies to detect and prevent them (Franklin and Mathew 1994). However, subsequent studies on cardiac arrest antecedents (Bedell et al. 1991, Franklin and Mathew 1994) suggested that these physiological warning signs were not noted or adequately responded to by nurses and doctors. This led to recommendations that strategies to prevent cardiac arrest should include education for nurses and doctors on how to recognise and address cardiovascular deterioration - cardiac arrest being the end result of prolonged physiological deterioration which may have been detected by nurses'

measurement of, and prevented by nurses' response to, abnormal vital signs (Hillman, Bristow et al. 2001, Kause, Smith et al. 2004, Buist, Harrison et al. 2007).

In order to understand the significance of the preventable aspects of serious adverse events such as cardiac arrest, Bedell et al. (1991) studied the incidents and characteristics preceding them. Following a chart review of 203 patients who suffered a cardiac arrest in a North American teaching hospital, 28 were considered to have had pre-defined iatrogenic complications prior to the arrest. Most of the iatrogenic complications involved medication errors, but seven cases appeared to be directly related to a failure to recognise or respond to altered physiological signs and symptoms, which included respiratory problems, elevated heart rate and chest pain (Bedell, Deitz et al. 1991). Further to this study, Franklin and Mathew (1994) over a 20-month period, examined the frequency of premonitory signs and symptoms in a cohort of 150 medical inpatients who had suffered a cardiac arrest in a North American general public hospital. All the patients' charts were reviewed for predefined abnormal vital signs within 48 hours of the event. Of the 150 patients who suffered a cardiac arrest, 99 had experienced documented deterioration in the six hours preceding the event. In 25 of the 99 cases medical staff had not been advised of that deterioration by a nurse. Of the medical staff who were aware of the alteration in the patient's condition, a number failed to act upon those findings. Despite the variability in recognising signs of deterioration, these findings demonstrated the important role of nurses in reporting or acting on signs physiological of deterioration.

Later, McQuillan et al. (1998) in a study on quality of care showed that patients received suboptimal management of oxygen therapy, airway, breathing, circulation and monitoring before admission to intensive care (McQuillan, Pilkington et al. 1998). Massey et al. (2008), adopting categories

used by McQuillan et al. (1998), identified that suboptimal ward care still exists and is linked to a lack of knowledge regarding the significance of clinical findings related to dysfunction of airway, breathing and circulation (Massey, Aitken et al. 2008). Systems to address suboptimal care have been established both within Australia and internationally in response to such findings.

2.2.1 Establishing systems to detect and manage the acutely ill person

In response to the identification that up to 40 per cent of intensive care admissions are potentially avoidable and that approximately half received suboptimal care before their admission (Hillman 2008), systems were established to support health care practitioners. The most common system, as previously described is the medical emergency team (MET), which was implemented in 60 per cent of acute care hospitals in Australia and New Zealand by 2005, expanding internationally about the same time (Jones, George et al. 2008).

An MET was first instituted in Liverpool Hospital, New South Wales (Hourihan, Bishop et al. 1995) based on a set of predefined vital signs, to identify, review and treat acutely unwell ward patients. The call criteria were validated as predictors of serious adverse events through an analysis of the Signs of Critical Conditions and Emergency Responses (SOCCER) database (Jacques, Harrison et al. 2006). The database was derived from a cross-sectional survey conducted over two weeks of 'Do Not Attempt Resuscitation' adult admissions, examining the case notes of 3,160 adult admissions in five Sydney metropolitan hospitals for a selected range of abnormal physiology indicators (Jacques, Harrison et al. 2006). The survey identified 26 early signs and 21 late signs of critical conditions and serious adverse events: severe respiratory problems, transfer to a critical care area, cardiac arrest or death (Jacques et

al. 2006). The study confirmed the MET call criteria, but also established that the MET system used clinical signs, which occurred late in a patient's deterioration (Harrison, Jacques et al. 2006, Jacques, Harrison et al. 2006) which may not be helpful in detecting early changes.

The SOCCER study suggested that some early signs of critical illness are also predictive of serious adverse events and are thus worthy of inclusion in MET call criteria (Jacques, Harrison et al. 2006), but cautioned that these signs have a high prevalence, meaning that there could be a high rate of costly false positives were they to be used as call criteria on their own. Harrison and colleagues (2006) using the same data set as that in the SOCCER study identified 26 early signs or symptoms and 21 late signs or symptoms of critical conditions. The signs were pre-identified by senior emergency and intensive care doctors and nurses from the five participating Sydney hospitals, and medical records from those hospitals were searched. The data used unexpected death in hospital as the outcome measure. The signs identified as the most useful additions to a medical emergency response system fall into the following categories of change: cardiovascular, respiratory, renal (urinary) output, level of consciousness, and/or altered blood gases (Harrison, Jacques et al. 2006). The study also supported the addition of pulse oximetry to existing call criteria.

Despite establishing call criteria and systems to detect and manage the deteriorating patient through a (MET), a multicentre prospective randomised cluster trial found no difference in death rates between hospitals with a MET using MET criteria and hospitals with no MET but with a cardiac arrest team (Hillman, Chen et al. 2005). The Hillman et al. study was conducted in 23 Australian hospitals over a twelve-month period, with twelve hospitals assigned a MET and eleven to practicing standardised care (Hillman et al. 2005). Analysis after six months showed no improvement in cardiac arrest

rates, intensive care admissions, or unexpected deaths. The implications of the study remain the subject of debate, as it has been suggested that design limitations may have resulted in the negative findings. Additionally, the study was underpowered for detection of a significant difference in the incidence of primary outcomes. Further, inter-hospital variability was higher than anticipated.

A prospective before and after trial of a medical emergency team in a tertiary referral hospital suggested that incidence of in-hospital cardiac arrest and death following cardiac arrest, bed occupancy related to cardiac arrest, and overall in-hospital mortality decreased following introduction of a MET system (Bellomo, Goldsmith et al. 2003). Though often cited in support of the implementation of a MET system, the study was conducted in a single centre and only captured data from surgical wards, thereby neglecting the complexity of patients with non-surgical conditions. The majority of published research relating to the MET system has been conducted in single centres and reports a reduction in adverse outcomes associated with early recognition and intervention in clinical deterioration (Barbetti and Lee 2008). A consistent observation in these studies is the reported presence of clinically abnormal vital signs prior to deterioration.

Early warning scoring systems (EWS) to alert health care workers to signs of deterioration were also considered useful for determining which vital signs should be measured, when they were to be measured, and the frequency at which they should be recorded, as it was believed that these factors are not always fully understood (Smith, Chiovaro et al. 2014, So, Ong et al. 2015). A systematic review undertaken by Smith et al. (2014) of the evidence on the ability of EWS to predict patients at risk of deterioration identified one controlled trial and 20 observational studies. The pre-post designs of the remaining studies had significant methodological limitations, but the

controlled trial found no difference in mortality, transfers to critical care or length of stay. Overall, the review concluded that EWSs perform well in the prediction of cardiac arrest and death within 48 hours (Smith, Chiovaro et al. 2014).

Le Lagadec and Dwyer (2017) reviewed 565 publications, including government documents, reports and theses in their scoping review of EWS. They found that there is low level quantitative evidence that EWSs improve patient outcomes and strong anecdotal evidence that they support clinical staff in deterioration detection and response. The review identified that the efficiency of the EWS appear to be dependent upon patient cohort, organisational facilities, staff training and attitude, but cautioned that EWSs cannot replace good clinical judgement, given the reliance on human factors in decision-making (Le Lagadec and Dwyer 2017). Given the limited evidence for protocols and lack of adherence, it is likely that the implementation of systems to address recognition and response to physiological deterioration is an over simplified solution to a complex problem.

Despite the lack of robust evidence to support the effectiveness of a system such as the MET, rapid response or early warning systems have continued to be promoted as the optimal approach to detecting and managing deterioration in acute care hospital settings. Issues around their implementation such as education, human and financial resources and communication are also considered vital to the successful implementation of METs (Barbetti and Lee 2008). Due to the sensitivity and specificity of the variables involved in early warning systems that influence patient outcomes however, questions as to whether the optimal call criteria ought to integrate vital signs have yet to be addressed. Although clinical observations such as elevated respiration rate (tachypnoea), decreased level of consciousness and systolic hypotension (low blood pressure) are associated with in-hospital

cardiac arrest and death, different combinations of criteria are in use, and there is no consensus as to the ideal set of criteria or their optimal cut-off points (Cretikos, Chen et al. 2007). Therefore there continues to be widespread interest in establishing an optimal early detection and response model to provide assistance to nurses and medical staff, and which also facilitates their clinical decision making.

2.2.2 Nurses intuitive knowledge for detecting acute illness

Identified by both the SOCCER study researchers (2006) and by Harrison (2006) was that the nurses' subjective, intuitive 'sense' that a patient is deteriorating is important for the delivery of early intervention (Harrison, Jacques et al. 2006, Jacques, Harrison et al. 2006). The MET has therefore evolved to be activated on the basis of either the measurement of vital signs, or of subjective concern about a patient's condition (Guinane, Bucknall et al. 2013). Despite the controversial nature of intuition as a concept (Robert, Scott Tilley et al. 2014), research has validated its use in decision making by nurses, particularly in relation to recognising deterioration.

Odell, Victor and Oliver (2009) in a systematic literature review, found that nurses are unlikely to use the physiological ranges embedded in an early warning system to determine deterioration. Instead, as other research has demonstrated, while nurses may at times detect deteriorating patients through vital sign changes, the main process for recognising deterioration is through intuitive knowledge reflecting past experience (Cioffi 2000, Cioffi 2000, Cioffi 2001, Minick and Harvey 2003). Intuition is built upon knowledge of patients (Cioffi 2000, Kenward and Hodgetts 2002, Minick and Harvey 2003) and recognition of illness patterns (Cioffi 2000, Cioffi 2000, Kenward and Hodgetts 2002, Minick and Harvey 2003). However, time with a patient is required for a nurse to be able to detect subtle changes in their clinical signs

and behaviour. Pattern recognition, requires repeated exposure to similar patients with the same conditions to recognise subtle deviations from their usual health status. Each of these findings suggests the need for an experienced, stable workforce (Odell 2010), which may be difficult to attain during times of staffing shortages and increasing and complex workloads.

Additionally, if nurses in acute hospital wards rely on knowing their patient and on the likely patterns of illness trajectory, it may follow that they remain unconvinced about identifying deterioration through the use of vital signs which have changed from normal (Odell 2010). The contrast between intuitive knowing about the patient and objective readings of their vital signs could partially explain why MET activation is not initiated early enough, or indeed at all. Experienced nurses, however, may call for assistance before changes in vital signs occur based on their intuitive feelings (Odell 2009), while less experienced nurses are challenged on their critical thinking and decision making (Brier, Carolyn et al. 2016), and thus require increased support and supervision.

A nurse may activate a MET using a 'worried' call criterion. Neither intuitive knowing nor a 'worried' call criterion has been validated as showing better patient outcomes. Nurses have the opportunity in some MET systems to use the 'worried' criterion if they believe something is wrong with a patient. Douw and colleagues (2015) performed a systematic review to identify the signs and symptoms that trigger nurses' worry or concern about a patient's condition. Ten general indicators underlying worry or concern were identified as indicators of deterioration and supporting intuitive feelings. The indicators included alteration in breathing, circulation, any rigors and changes in mentation that preceded vital sign changes. Other indicators, which were not related to vital signs, were agitation, pain, unexpected trajectory and the patient indicating that they are feeling unwell (Douw, Schoonhoven et al.

2015). Importantly the indicator 'knowing without a rationale' was identified by Douw, Schoonhoven et al. as intuitively knowing that something is wrong based on possibly unconscious observational skills used by nurses (Douw, Schoonhoven et al. 2015). The findings from this study have not yet been translated into modifications to existing early response systems.

The 'worried' category was identified as important to nurses when ADDS implementation was researched in a regional health service in Australia (Missen, Porter et al. 2017). The study aimed to assess, through exploring data from a risk database, the impact of ADDS upon the number of MET and Code Blue activations. Though there was an increase in MET activations from 5.91 to 11.27 per 1000 admissions ($p<0.01$) after ADDS was implemented, there was a reduction in the use of the 'worried' criterion. Prior to the introduction of ADDS, the most common reason for MET activation in the worried category was low oxygen saturations or breathing problems. After the implementation of ADDS, the most commonly used sub-categories in the worried criterion were "not quite right", followed by "chest pain" (Missen, Porter et al. 2017, p.4). Though a single site study, the results of this research help to define how the worried category is used in ADDS by nurses.

The ability to make independent decisions depends on experience, which reflects a range of information gathered at the bedside and by other means. Two studies conducted with inexperienced nurses under simulated laboratory conditions, identified that, on graduation, students of nursing may be ill prepared to identify and manage ward patients whose condition is deteriorating (Cooper, Kinsman et al. 2010, McCallum, Duffy et al. 2013). Additionally, first year nurses also demonstrated an inability to look beyond a tool used to detect deterioration, toward a more holistic patient assessment (Endacott, Scholes et al. 2010). Recommendations for nurse education from

similar studies emphasised the importance of improving nurses systematic assessment to make high consequence decisions (Purling and King 2012), and of the ability to connect information in order to link pathophysiology with patient assessment including vital signs (Endacott, Scholes et al. 2010).

2.2.2.1 Nurses health assessment

In order to identify the assessment skills nurses used in practice, Osbourne et al. used a single centre, cross-sectional survey design (n=434) to determine minimum core skills against an adapted Physical Assessment Skills Inventory. The researchers found that the majority of nurses said they undertook measurement of temperature (85.6%), oxygen saturations (85.4%), blood pressure (75.4%), and that they assessed breathing effort (57.6%), skin (colour and tone 76.1%), and wound (64.3%) and mental status (60.9%) (Osbourne, Douglas et al. 2015). The findings indicated that nurses used only 10/133 (7.5%) of the physical assessment skills available for selection from the inventory. Skills utilisation differed between clinical areas with mental health nurses reporting fewer skills used than those on surgical and medical wards. Nurses with more than 10 years' experience, postgraduate education and senior clinical positions were found to use significantly fewer core skills in their assessments, but no reasons for these finding were given or suggested. Reliance on others and on technology, lack of confidence, specialty area and clinical role were significant predictors of core skills utilisation (Osbourne, Douglas et al. 2015).

There is a lack of evidence that nurses use a consistent approach to assessing and managing patients which may lead to less-than-optimal patient outcomes, and which could potentially prevent admission to intensive or high acuity care (Chalfin et al. 2007), or could result in an adverse event such as cardiac arrest or death (Vlayen, Verelst et al. 2012). Possible contributors to nurses' inconsistent assessment practice include lack of knowledge, reliance

on routine vital sign measurement, misinterpretation and mismanagement of abnormal vital signs, lack of supervision, and failure to report changes in a patient's condition or to seek advice (Fernandez and Griffiths 2005, Thompson, Bucknall et al. 2009).

In response to the apparent lack of systematic structure to assessment, Brier and colleagues (2014), in an international mixed methods study with nurses in the United States and Israel, tested an algorithm designed to guide nurses' critical thinking. The algorithm included systematic surveillance, assessment, actions required and strategies for communication. Using semi-structured interviews, ten nurses (five from each hospital in the study) provided their expert knowledge on assessment factors, observations and intervention strategies they believed were consistent with early identification and timely management of patient deterioration. The researchers made distinctions between monitoring of a patient (which omits analysis) and surveillance, suggesting the latter is 'purposeful and ongoing acquisition, interpretation, and synthesis of patient data for clinical decision making' (Brier, Carolyn et al. 2014, p.833). The researchers used the interview data to develop a clinical algorithm for surgical patients based on: (1) visual cues when arriving at the bedside; (2) investigating potential reasons for the observations, including potential influencing factors; (3) validating findings with additional data and with others; (4) reporting findings; (5) recommending a course of action; (6) documenting findings, actions and responses, and; (7) reassessing (Brier, Carolyn et al. 2016). Whilst this publication may be useful to guide to support clinical decision making for the inexperienced nurse, it has a number of limitations. Data were derived from expert nurses from retrospective recall of recent events, and the sample size is small and may not be representative of a broader audience of nurses. Further, the implementation and evaluation of the algorithm in practice is recent and ongoing.

Parker (2014) undertook a descriptive, cross-sectional, correlational quantitative study to determine the relationship between nurses' decision making model during rapid response team activation and the frequency of such activations. Of the 87 registered nurses (RNs) studied, 70.1 per cent used an analytic/intuitive decision making model, 21.8 per cent (n=19) used an analytic decision-making model, and 8 per cent (n=7) used an intuitive decision-making model. RN's who used analytical decision-making activated the rapid response team more often than either intuitive or mixed model decision makers, and this higher activation frequency has the potential to positively affect patient outcomes (Parker 2014). Analytical decision-making involves collecting data, formulating a hypothesis about what may be occurring and continuing data collection until a correct decision has been reached. Intuitive decisions are made without developing a rationale (Parker 2014) and are more prevalent among experienced nurses, who, for the purposes of this study, were described as older nurses with years of experience, and with longer tenure in their current unit. An early warning response system, such as an MET, therefore cannot be used by nurses in isolation from intuitive actions, as such systems also require an element of decision-making.

Thus far the literature suggests that patient deterioration is a problem in acute care settings. Early warning and response systems do not appear to be addressing the problem. Nurses use more cues than vital signs to make decisions about patients in their care. Intuitive knowledge of the patient is used by experienced nurses for decision-making. Vital signs, however, do form an integral component of early patient deterioration detection systems, and may be at odds with nurses' in-practice decision-making responses.

2.3 The acutely ill patient as an object for measurement

Research highlights the association between abnormal vital signs and mortality and that the relationship to nursing practice is significant. This theme addresses the role of vital signs perform in patient assessment and how they are measured, along with recommendations as to how frequently they are to be performed. The use of technology in nursing practice is also presented.

Lighthall, Markar and Hsiung (2009), in an observational study to identify the frequency of abnormal vital signs in medical and surgical ward patients in association with unplanned intensive care transfers, cardiac arrest, and mortality, reported that 170 (15%) patients had abnormal vital signs, and of these, 59 (35%) had an adverse event. The number of adverse events doubled when patients had more than two abnormal vital signs. In another study by Fuhrmann et al. (2008), patients with abnormal vital signs were found to have a threefold increased mortality rate (Fuhrmann, Lippert et al. 2008). Each of these studies reveals that even a single record of an abnormal vital sign signals an increased risk of an adverse event in hospital ward patients. Abnormal vital signs during hospitalisation signify impaired physiological reserve, and that places a patient at higher risk of mortality, even after hospital discharge (Lighthall, Markar et al. 2009, De Meester, Van Bogaert et al. 2013). The use of vital signs in early warning and response systems appears to be justified if only to reduce mortality, but interpreting vital signs without considering other patient cues may be difficult and even misleading.

2.3.1 The reliability of vital signs

Traditionally, the vital signs measured by nurses in an acute care setting are temperature, pulse, respirations and blood pressure, Increasingly since the

early 1990's, pulse oximetry has been added to this list (Carlson and Jahr 1993, Evans, Hodgkinson et al. 2001, Aherns 2008). A systematic review examining the positive likelihood ratio for the different thresholds of each vital sign used in early warning scores identified that the subject is poorly studied, and that many of the studies that do exist have methodological flaws (Storm-Versloot, Verweij et al. 2014). Thus, it seems reasonable to conclude that the results so far gathered fail to definitively support abnormal vital signs as a useful tool to predict adverse events. The review found that only three studies provided results for the various different thresholds. Heart rate greater than 90 beats per minute, or equal to or greater than 99 beats per minute showed no significant differences in the area under the receiver operator characteristic curve (AUC) (Mato, Fuchs et al. 2009). Body temperature measurement, too, was found to have limited value in the early detection or exclusion of infection (Vermuelen, Storm-Versloot et al. 2005), and further it has been shown that patients at risk cannot be identified with routine oxygen saturation monitoring (Smith, Prytherch et al. 2012). Despite this evidence, vital signs remain intrinsically linked to the early warning systems used by nurses. Moreover, ward nurses are required, through the auspices of an early warning system, to raise concerns and further it has been shown that patients at risk cannot be identified with routine oxygen saturation monitoring with doctors about changes in individual vital signs (Chua and Liaw 2015) in spite of their apparent fallibility (Lavoie, Pepin et al. 2016).

Vital signs, as a measurement for determining the severity of a patients' condition, are linked, through research, to patient outcomes. Large single centre studies have demonstrated relationships between abnormal vital signs and serious outcomes (Bleyer, Vidya et al. 2011). However, as individual measurements, vital signs are not without problems, and the following section considers the evidence for each parameter.

2.3.1.1 Respiration

Respiration is often the first of the vital signs to show a variance in deterioration, yet its importance is undervalued by nurses and medical professionals, as respiration rate is measured in only one fifth of all sets of vital signs, and is the least often recorded and most frequently omitted (Cretikos, Bellomo et al. 2008, Mitchell and Van Leuvan 2008, Flenady, Dwyer et al. 2016). Hillman and colleagues (2001), over a six month period studied antecedents to hospital deaths in patients with cardiac arrest (n=171) in three separate acute care hospitals, finding that after hypotension (30%), tachypnoea (17%) was the next most common predictor of a patient requiring urgent intervention (Hillman, Bristow et al. 2001).

Respiration is usually measured by observing the number of times a patient's chest rises in a minute. However, in busy clinical environments, the measurement duration of 60 seconds is perceived to be too time consuming (Karlen, Gan et al. 2014), so the number of times the chest rises is instead counted for a fraction of 60 seconds and the result multiplied up to the full minute. A small scale qualitative study using three focus groups conducted with nurses (registered, health care assistants and students of nursing) from general surgery, orthopaedic surgery, medicine, and emergency departments, identified that it was difficult to count patients' respirations without the patient being aware and therefore affecting their breathing pattern (Hogan 2006). Nurse reported respiration rate was the one vital sign recorded less than 50 per cent of the time (Hogan 2006).

Respiration rates are often assessed inaccurately which can negatively influence responses to a patient's condition (Cooper, Cant et al. 2014., Philip, Pack et al. 2015, Badawy, Nguyen et al. 2017). Research undertaken on 159 consecutive patient presentations to an emergency department compared

electronic monitoring to standard measurements of respiration rates, demonstrating that respiratory assessments by nurses in emergency wards are not accurate in detecting slow and fast respiration rates (Lovett, Buchwald et al. 2005). Another study, using a questionnaire, reported perceptions of ward nurses (n=41) regarding methods of assessment and reliability of respiration rate recordings in ward observation charts. The results demonstrated low confidence in the reliability of respiratory records, with nurses believing that measurement of respirations is often estimated with no formal measurement performed (Philip, Richardson et al. 2013), which leads to questions regarding the accuracy of such measurements (Philip, Richardson et al. 2013, Philip, Pack et al. 2015).

To test the accuracy of estimated respiration rates as compared to formal assessment, doctors (n=54) in a London teaching hospital were studied using simulated patients with a known constant respiration rate (Philip, Pack et al. 2015). The doctors had up to twelve seconds to make a visual estimation of the rate and record it. The same videos were replayed, providing the doctors with time to make a formal assessment, defined as counting the rate for 30 seconds and multiplying by two, if the rate was regular and constant. If irregular, the rate was counted for a full minute. The imprecision of both methods increased as the respiration rate increased, and was consistently higher using the visual estimation method compared with formal assessment (Philip, Pack et al. 2015). In practice, visual or 'spot' estimates of 18 to 20 breaths per minute are disproportionally common (Badawy, Nguyen et al. 2017) which may lead to misclassification of severity of illness.

2.3.1.2 Pulse oximetry

MET systems are usually set to activate a response when pulse oximetry readings fall below 90% in spite of oxygen therapy (Gunathilake, Lowe et al.

2014). Worsening blood oxygen saturation through measuring pulse oximetry was the most frequent cause of deterioration, and was associated with the highest 30-day all-cause mortality rate in a large (n=1,440) single centre retrospective cohort study of acute medical patients with complete follow up (Hong, Earnest et al. 2013). Pulse oximetry, as a method to analyse the oxygen carrying capacity of blood, is useful for patients with known pulmonary conditions following surgical or invasive medical procedures (Taenzer, Pyke et al. 2010), and in reducing the rate of arterial blood gas sampling in critical care areas (Perel 2015). However no study has been identified that evaluated the effect and utility of the routine use of pulse oximetry in general medical wards (Evans, Hodgkinson et al. 2001). Indeed, the use of pulse oximetry by nurses has received some critique, as the accuracy of pulse oximetry is subject to many limitations (Considine 2005) and knowledge of its use is in question (Elliott, Tate et al. 2006, Kiekkas, Alimoutsi et al. 2012). In spite of this, the advantages of using pulse oximetry have been proposed to outweigh the disadvantages (Considine 2005).

The British Thoracic Society (BTS) published guidelines in 2008 for oxygen administration, recommending a target oxygen saturation (SpO_2) of 94-98 per cent for most adult patients and that pulse oximetry must be available wherever oxygen is used. The guidelines were updated in 2017 with little change (O'Driscoll, Howard et al. 2017). The recommendations from the BTS rely on consensus opinion and on small studies which used arterial blood gas measurements (Smith, Prytherch et al. 2012). Analyses of SpO_2 values for 37,299 medical admissions aged 18 years or older provided results that were distinctly different from those upon which the BTS guidelines of normality were based. Smith, Prytherch et al. (2012) suggest that the BTS should consider raising its target saturation to 96–98 per cent for actively treated patients not at risk of hypercapnic (elevated carbon dioxide) respiratory failure. It is interesting to note that the revised BTS guidelines (2017) do not acknowledge this important research finding.

2.3.1.3 The pulse

Manually taking a pulse establishes touch with a patient, and also includes checking the pulse rate, regularity, character and arterial blood volume (Nicholson 2014). In addition, the arterial pulse has been used in trauma or emergency situations as an estimation of blood pressure. Deakin and Low (2000) found that systolic blood pressure was generally overestimated by pulse checking and was not to be relied upon (Deakin and Low 2000). In contrast, Ryan and colleagues (2008) identified that a palpable but weak radial pulse was associated with an average systolic blood pressure of just greater than 80 mmHg (Ryan, Batchinsky et al. 2008). These divergent results are difficult to rely upon, as both studies were small, were performed under different conditions (laboratory versus trauma hospital), used different methods (blood pressure cuff versus invasive arterial cannulation) and took place in different patient populations (healthy volunteers versus trauma patients). Importantly, Ryan and colleagues concluded that a detrimental change in pulse character could influence patient outcome and would thus appear to be more important than rate alone. Manually taking a pulse is important, therefore, in ascertaining early changes in the condition of a patient through more than rate checking.

The act of manually taking a pulse is also important to the detection of a disturbance in cardiac regularity. Atrial fibrillation, a rapid irregular heart rate is the most common arrhythmia and due to the ageing population and escalating levels of obesity, its incidence is predicted to continue to rise (Miyasaka, Barnes et al. 2006). Atrial fibrillation, though often symptomless, is easily detected by taking a pulse, but if it is left undetected can lead to adverse events such as stroke and hypertension (Thomas, Dublin et al. 2008). Further, if the pulse is rapid and the rate is uncontrolled, atrial fibrillation can cause the symptoms of a reduction in cardiac output (Wang, Larson et al. 2003), thus potentially reducing systolic blood pressure. A cross sectional

survey of UK practice nurses (n=181) identified that one quarter did not palpate the pulse during the electronic measurement of blood pressure, thus missing the opportunity to screen for changes in heart rate regularity (Madoc-Sutton, Pearson et al. 2009). On this evidence, it is clear that the act of taking a pulse can impart important information for clinical decision-making by the nurse.

Pulse rate can be misleading due to factors such as patient presentation, medical or operative variables or, medications prescribed to slow the heart rate (Scali, Bertges et al. 2015). In the setting of trauma, tachycardia (a heart rate over 100 beats per minute) is considered an early sign of fluid loss, but in practice is not necessarily a reliable indicator (Yeh and Velmahos 2012). Multivariate logistic regression was used to determine significant risk factors for mortality identifying that bradycardia (a heart rate less than 60 beats per minute) was common in hypotensive adult trauma patients older than 55 years of age (44% of patients, n=3,727), and was associated with increased mortality (Ley, Salim et al. 2009). A low heart rate may be normal, and as long as a slow heart rate (bradycardia) is not associated with concomitant aberrations in other vital signs, a slow pulse may not require intervention (Mason and Lonnqvist 2015). Tachycardia and bradycardia may be unreliable indicators, and the significance of the way in which this is taught to nurses working in clinical wards is unknown.

2.3.1.4 Blood pressure

Blood pressure provides a dynamic quantitative snapshot of haemodynamic activity in one part of the arterial system (Noon 2009), and can be affected by many factors, both external and internal. Blood pressure varies with age, sex, health, and race or ethnicity, and taking blood pressure is a skill taught to most health professionals (Ferns 2010). A large, international, multicentre,

prospective, observational study identified hypotension as one of the most common abnormal physiological signs preceding a primary event such as unplanned intensive care admission, cardiac arrest or death (Kause, Smith et al. 2004). However, blood pressure alone was found not to be a reliable predictor of clinical outcomes (Hong, Earnest et al. 2013). Though blood pressure is an important signal for patient deterioration, it can be misleading if not interpreted in context and related to its effect on organ perfusion as measured by mean arterial pressure.

Nurses who measure blood pressure have the opportunity to consider systolic and diastolic readings as well as mean arterial pressure (MAP), but the literature suggests that this latter sign is not used in hospital wards. MAP is the average of the blood pressure throughout the arterial circulatory system, representing perfusing pressure necessary to maintain end organ perfusion (Bradshaw 2012). MAP, as an important determinant of organ perfusion (Leone, Asfar et al. 2015), is underrepresented in data collection by nurses. Its significance lies in the fact that a patient's blood pressure may appear unremarkable even though the mean arterial pressure may indicate significant change in intravascular status (Bradshaw 2012). Prolonged hypotension, defined as a mean arterial pressure of less than 60 – 65 mmHg is associated with poor outcome (Leone, Asfar et al. 2015).

MAP is also identified as an important variable for monitoring in patients suspected of having sepsis. The Surviving Sepsis campaign recommends targeting a mean arterial pressure of at least 65 mmHg during initial resuscitation of patients with septic shock (Asfar, Meziani et al. 2014, Howell and Davis 2017). The incidence of sepsis in hospital ward patients is generally attributed to the increasing incidence of chronic conditions in an ageing population, with 17.5 per cent of in-hospital deaths in NSW attributed to sepsis (Burrell, McLaws et al. 2016). Given the lack of clarity about vital signs,

MAP as a measure of organ perfusion, may be a more reliable vital sign to monitor than systolic and diastolic pressure.

2.3.1.5 Temperature

Body temperature is the measure of the ability to generate and remove heat which in the hospitalised patient, may be a sign of infection or inflammatory changes (Lopez-Bushnell, Demaray et al. 2014). Temperature elevations (greater than 38.3^{o}C) are present in 29-36 per cent of hospitalised patients (Celik, Yildirim et al. 2011) as a result of infectious or other events, such as drug reactions, cardiac problems, trauma, surgery and inflammatory responses. A prospective, repeated measure study of 35 patients in a neurosurgical intensive care unit found that an elevated temperature led to a decrease in systolic blood pressure, and arterial oxygenation, and to an increase in heart rate (Agasor Pour and Yavuz 2014), thus emphasising the significance of this vital sign to overall health status.

An opportunistic cross-sectional sample of qualified and unqualified nursing staff (n=139) regarding the patterns of temperature measurement and frequency was examined by questionnaire in a medium-sized hospital in the UK (Evans and Kenkre 2006). The study identified that temperature measurement was an activity frequently undertaken by nurses with the fewest years of experience, a finding which has implications for identification and interpretation of deterioration. Signs and symptoms of sepsis for example - a leading cause of death and intensive care admission -, include extremes of temperature variation (fever or hypothermia), which may be recognised late and treated inappropriate (Lopez-Bushnell, Demaray et al. 2014).

2.3.1.6 Age related changes to vital signs

Increasing age is considered an independent risk factor for physiological deterioration and the implication of age related changes in vital signs has been poorly characterised. An observational study (n=269,956) of patients who had an age documented admitted to a hospital ward, was conducted in five hospitals in the United States (Churpek, Yuen et al. 2015). Patient characteristics and vital signs prior to cardiac arrest (422 index ward cardiac arrests) were compared between patients 65 years or older and patients aged less than 65 years. The area under the receiver operating characteristic (ROC) curve for vital signs and the modified early warning score (MEWS) were also compared. Elderly patients had a higher cardiac arrest rate (2.2 versus 1.0 per 1,000 ward admissions; $p<0.001$) and in-hospital mortality (2.9% versus 0.7%; $p<0.001$) than non-elderly patients. Within four hours prior to the event, elderly patients had a significantly lower heart rate (88 versus 99 beats/minute; $p<0.001$), and diastolic blood pressure (60 versus 66 mmHg; $p=0.007$), and higher pulse pressure index (0.45 versus 0.41; $p<0.001$) and temperature (36.4^0C versus 36.3^0C; $p=0.047$). The area under the ROC curves for all vital signs and early warning scores was higher for non-elderly patients than elderly patients. The results show that vital signs more accurately detect cardiac arrest in non-elderly patients than elderly patients, which has implications for how vital signs are used for identifying seriously ill patients in either age group.

2.3.1.7 Summary of vital sign fallibility

In spite of reliance on vital signs as a tool to detect deterioration, and of medical literature validating their significance in identification of the patient at risk of deterioration, there are many variables within individual signs. Individual patient variances and age-related changes are not accounted for in the response criteria that nurses use to alert medical staff to physiological deterioration. Lack of attention to the measurement of vital signs, counting

respirations, ignoring the physical act of pulse taking, and avoiding integrating all vital sign measurements, for example suggests a degree of inaccuracy in vital sign interpretation, resulting in ineffective assessment of the patient.

2.3.2 Effective use of vital signs for measuring and communicating deterioration

If vital signs are measured sporadically, are not considered in context, or are incomplete, a deterioration response system is presumed to fail, and the appropriate response team may not be activated (Smith, Prytherch et al. 2006, Guinane, Bucknall et al. 2013, Le Lagadec and Dwyer 2017). During a cluster, randomised control trial of the MET response system in 23 Australian hospitals, close to 77 per cent of patients suffering an adverse event had had at least one vital sign, usually respiration rate, missed being measured immediately before the event (Chen, Hillman et al. 2009). In other retrospective studies, the introduction of an early warning response system appeared to increase the frequency of measuring and documenting vital signs, but the completeness of this measuring and documenting remained poor (Chen, Hillman et al. 2009, DeVita, Smith et al. 2010, Guinane, Bucknall et al. 2013).

Odell (2014), undertook an audit of patient records in the twelve hours prior to cardiac arrest to identify ward nursing practice in adherence to an early warning scoring protocol intended to detect and manage the deteriorating ward patient, and also to investigate factors that may affect practice. Her findings suggest that there was improvement in ward patient monitoring practices compared to earlier research, but that there remained errors in early warning scoring systems in which abnormal vital signs are allocated a numerical code and non-adherence to protocols remained a problem (Odell 2014).

Vital sign omissions are consistently identified in the literature with a post hoc analysis of data from 7,851 patients in 300 hospitals revealing that 55 per cent of patients having an in-hospital cardiac arrest had no documented vital sign recordings in the four hours prior to that arrest (Anderson, Kim et al. 2015). This is despite the fact that the patients were monitored via electrocardiography (monitored rhythm), pulse oximetry and/or apnoea devices at the time of arrest, and/or were being cared for in areas with continuous electrocardiographic monitoring. Smith (2016) raises the following question: does omission of vital signs represent quality of care issues that require investigation, or, alternatively, does it show that nurses elect not to monitor patients' vital signs for reasons unknown (Smith 2016)?

2.3.3 Variations in optimal vital sign frequency

Guidelines released in 2007 by the National Institute for Health and Clinical Excellence, and in 2012 by the Australian Commission on Safety and Quality in Health Care (ACSQHC), recommended that patients should have a full set of vital signs taken on initial assessment, when they are admitted to hospital or when being transferred from a critical care area to a general ward. This baseline is designed to allow future recordings to be compared and to support care decisions, in particular to transfer a patient for more specialist care (Elliott and Coventry 2012). However, there is limited research evidence regarding the frequency with which vital signs should be monitored, and much of this is based on surveys of nurses, on clinical practice reports and on expert opinion. Vital signs measurement and recording is consequently viewed as a ritualistic exercise (Evans, Hodgkinson et al. 2001, Considine and Botti 2004, Zeitz and McCutcheon 2005). Odell (2009) suggests that, in practice, the majority of vital sign recordings are planned at regular intervals, and may become governed by routine as a result. Research has not provided consistent support for the practice of repeating vital sign measurements in a

regimented pattern for every patient (Storm-Versloot, Verweij et al. 2014), yet ritualised practice continues (Burchill, Anderson et al. 2015).

With a paucity of evidence to drive vital sign practices, postoperative vital signs are the most readily apparent source of ritualistic practices. Zeitz and McCutcheon (2002), in a multicentre study, found that 36 of 47 hospitals had policies mandating some variation of postoperative vital sign assessment based on a complete set of vital signs (temperature, heart rate, respiration rate, and blood pressure). The vital signs were to be documented hourly for four hours, then every 2 hours for four hours and four hourly after this time (Zeitz and McCutcheon 2002). Follow-up studies using observational or mixed methods designs by the same authors found that little had changed in postoperative vital sign assessment, and that vital sign gathering is conducted in traditional, regimented patterns that may be unconnected to effective detection of postoperative complications (Zeitz, McCutcheon et al. 2004, Zeitz 2005, Zeitz and McCutcheon 2005).

More recent analysis of surgical nurses' attitudes toward postoperative vital sign assessment found that tradition rather than research continue to drive the practice of vital sign procurement (Burchill, Anderson et al. 2015). This is in contrast to changes in contemporary perioperative anaesthesia management, such as less use of general anaesthetic agents, improved intraoperative patient monitoring, and availability of medications, all of which have resulted in decreased postoperative complications, decreased recovery time and decreased length of hospital stay (Kolanek, Svartz et al. 2014, Thiele, Rea et al. 2015). Postoperative complications were noted by nurses to occur outside the routine postoperative vital sign assessment period (Burchill et al. 2015) and postoperative vital signs were considered not to be useful in detecting deterioration. A randomised control trial found no statistical difference between standard postoperative vital signs checks (n=96) and the

experimental group (n=93) who received more frequent vital sign checks (Fernandez and Griffiths 2005). Procedure-driven assessment and tradition appear to direct postoperative vital sign measurement.

The frequency of vital sign monitoring relies upon individual nurses' judgement and upon experience. A small focus group study reported nurses feeling it was 'up to them' to decide how often to undertake patient observation (Hogan 2006). In that study, vital signs were viewed by some as unimportant compared to other nursing duties (such as bed-making and patient hygiene), and some believed that vital sign checks could be delegated to others (Hogan 2006). While novice or less experienced nurses may obtain vital signs, they may also lack the knowledge, confidence or experience needed to identify the appropriate nursing interventions based on those signs (Cioffi 2001, Rathbun and Ruth-Sahd 2009), or the frequency at which they should be taken. This may contribute to unanticipated patient outcomes, or to an inadequate response to prevent deterioration occurring.

2.3.4 Obtaining vital signs, and changes in technology

The fundamental practice of measuring vital signs has changed with the advent of devices designed to reduce workload and to increase the speed of patient assessment. The difference between technology-derived and 'hands-on' vital sign measurement is pivotal in the literature, with the accuracy and reliability of each approach being debated. A systematic review undertaken by Skirton and colleagues (2011) to compare the accuracy and appropriateness of auscultatory anaeroid (manual with a stethoscope) and oscillometric digital (automated) devices for measuring blood pressure in clinical settings, identified sixteen studies for review, concluding that automated devices were less accurate than manual devices. In most cases, the automated device appeared sufficiently accurate for clinical use. There

were important exceptions noted. For example, hypertensive patients, patients with arrhythmias, and patients who had just experienced trauma were found not to be accurately assessable with automated devices. Despite awareness within the nursing profession that manual blood pressure measurements were more accurate (Kisiel and Perkins 2006), the practice of using technology to take vital signs continues. Practical evidence suggests using auscultatory methods in the management of hypertension or hypotension, or where there is significant potential for deterioration (Skirton, Chamberlain et al. 2011), each of which is an important aspect of the present study.

It is now common for electronic equipment to be used for the taking of all vital signs, bar respiration rate (Ansell, Meyer et al. 2015). Hogan (2006), using qualitative focus groups, found that nurses were not taking and recording respiration rates because the technology used did not do it for them automatically (Hogan 2006). More recently, in an observation study of nurse-patient interactions, measurement of vital signs occurred in 52 per cent of interactions (n=441), but the minimum vital signs required by the organisation in which the study took place were taken in only 6-21 per cent of instances of vital sign monitoring (Cardona-Morrell, Prgomet et al. 2016). Although technology enables monitoring to take place using electronic vital sign equipment, it appears to compromise the quality of patient assessment.

Overreliance on technology by nurses has the potential to result in missing cues of deterioration, as nurse-patient interaction is greatly reduced (Wheatley 2006); clinicians can acquire much more information by touching, talking and with, and by observing the patient's behaviour (DeVita, Smith et al. 2010). The omission of touch and the over-reliance on technology leads to questions about the role of vital sign measurements, and about nurses' understanding of physiological deterioration (Ansell, Meyer et al. 2015).

2.3.5 Section summary

The effectiveness of routinely measured vital signs has received conflicting evidence, particularly on the probability of early detection of adverse events, which may confirm the way that vital signs are used in practice (Storn-Versloot, Verweij et al. 2014). Variables in vital signs relate to age, patient condition, and health status. Technology is commonly used by nurses, and appears to have replaced the hands-on approach to patient vital sign assessment. The literature reveals that tradition informs the procurement of vital signs, and, in terms of individual signs, that omission of respirations or the practice of 'spot checking' leads to inaccurate reporting. The cause of these practices (and failures to practice) is not known. Nurses use vital signs to alert medical staff to changes in a patient's condition, and their vital sign practices are important to response systems

2.4 The acutely ill patient and nurses' agency

The interplay between structures such as organisational policy and nurses' agency may account for the way in which nurses act when caring for the acutely ill patient (Kahn, Qualter et al. 2012). When organisational policies such as METs or the ADDS are in place, it would be anticipated that health care professionals adhere to such policies. In relation to the measurement and reporting of vital signs, nationally and internationally, this does not seem to be the case. Nurses may express their vital sign agency in various ways. As a case in point, Ansell and colleagues (2014) undertook an investigation of when nurses would not take and record a patient's respiration rate. Respiration rate was selected as being the most sensitive vital sign for managing patients. Ten registered nurses working in adult wards in three hospitals in New Zealand were interviewed by phone. Data analysis presented the interviewees reasons for not taking respiration rates as complex, including issues such as time pressure, work interruptions, and rationalised

judgments made by experienced nurses. The authors concluded that patient respiration rate measures did not seem to be highly valued and questioned the level of understanding of respiratory physiology, as well as the extent to which intuitive nursing practice was supported by critical analysis (Ansell, Meyer et al. 2014). This in part supports earlier assertions that nurses are drawing upon an ever diminishing physical assessment skill set, which is not surprising given the requirements of a warning system which relies solely on vital signs as the cue of deterioration (Osbourne, Douglas et al. 2015). This does not explain, however, why nurses do not complete a full set of vital signs.

Odell's (2014) audit of ward nursing practice in the adherence to an early warning scoring protocol found that there are a multitude of contributing factors to the problem of non-compliance, and Odell advised that any possible solutions will need to reflect the breadth, depth and complexity of the problem (Odell 2014). Nurses' confidence, knowledge, skill, communication and relationships with the wider health care team were found to relate to referral decisions for patient deterioration.

2.4.1 Organisational culture influencing nurse agency

As a structural element which may influence nurses' agency, hospitals are among the most complex organisations in modern society. At the pinnacle of the hospital's social status stand the medical staff who exercise absolute medical authority; well below them in formal power, regardless of their day to day decision-making and potential spheres of influence due to sheer weight of numbers, are the nursing staff (Wilson 1963, Adamson, Kenny et al. 1995, de Raeve 2002, Adams and Bond 2003). The position of the nurse has evolved over time, stemming in part from the nurse–doctor relationship,

which is essentially patriarchal with embedded power relations (Bell, Michalec et al. 2014).

Research within healthcare highlights inequalities in professional culture (Falk, Hammar et al. 2015), and the fact that nurses as predominantly female, are oppressed or dominated by others (Puopora, Blegen et al. 2015). The gender division of work is characterised by the employment of women in part-time, semi-skilled or unskilled roles and of males in positions of supervision or management with greater career opportunities (Churchman and Doherty 2010). The nurse has long been portrayed as a person who carries out a subordinated and delegated subset of medical tasks, and this has been accompanied by the image of 'the subordinate professional' whose work is controlled by doctors (Chiarella 2002, MacMillan 2012). Other nursing work, though skilled, is of a lower professional status to medicine (Adamson, Kenny et al. 1995). This is in contrast to the perception of the nurse as an 'autonomous professional' who has control over regulation, knowledge and education, as well as clinical decision-making (Chiarella 2002, MacMillan 2012). Professional relationships with doctors are vital, and can affect the quality of care and of nurses' actions (Farrell, Walshe et al. 2017).

As the primary care providers, nurses have a pivotal role to play in the early identification of the patient at risk of deterioration through the taking and recording of vital signs. However, the role of the nurse has changed significantly in recent years, and has become increasingly complex (Kause, Smith et al. 2004). An Australian longitudinal study examining how much time nurses had for their patients showed that, on average over a three year period, time spent on direct and indirect care increased significantly, while time in professional communication declined (Westbrook, Duffield et al. 2011). In the United States, a time and motion study undertaken by Hendrich and colleagues (2008) into how 767 medical and surgical nurses spent their

working day, found that more than three quarters of all reported time was devoted to nursing practice. However, patient care activities accounted for 19.3 per cent (81 minutes) of nursing practice time and only 7.2% (31 minutes) of nursing practice time was used for patient assessment and reading vital signs (Hendrich, Chow et al. 2008).

On the premise that hospitals with a higher percentage of nurses with a tertiary education had lower rates of adverse events, Tourangeau et al. (2007), using backward regression, explored the impact of nursing care on 30-day mortality for acute medical patients. Amongst other findings, the study found that lower 30-day mortality was associated with hospitals that had a higher percentage of registered nurses, and a higher percentage of baccalaureate- (university-) prepared nurses (Tourangeau, Doran et al. 2007). It seems, in fact, that the presence of registered nurses is important to patient outcome, but also that the educational preparation of nurses may play a more important role

In relation to education on the recognition and management of deteriorating patients, a systematic review of 23 quantitative or mixed methods studies found that most educational programs structured around recognition and response to the deteriorating patient had a positive impact on learners' knowledge and performance in terms of the quality of patient assessment, with some programs reducing patient length of stay and adverse events, as well as activation and response of rapid response teams (Connell, Endacott et al. 2016). The education varied in length (median eight hours), and ranged from didactic lectures to high or low fidelity laboratory simulation. The educational interventions reviewed as having the most effective translation into practice included high fidelity simulations, particularly those delivered in-situ in hospital wards in the real world of health care delivery.

In addition to education, the level of experience of a nurse appears to have some effect on the assessment of vital signs and on responses to physiological deterioration. Wheatley (2006) performed a participatory observational study (n=20), including interviews (n=8), finding that the level of experience of the nurse is important in the assessment of patients. A qualitative critical incident technique study identified that enrolled nurses (n=15) required assistance to recognise patient deterioration. Chua et al. (2013) made recommendations for increased education and modification of clinical processes, such as supervision of the nurse in the interpretation of vital sign readings (Chua, Mackey et al. 2013). A more recent study that examined nurses' attitudes toward an organisation-wide modified early warning system designed to ensure closer monitoring of vital signs found that nurses' seniority affected the attitude of medical staff who were asked to review a patient, with the medical staff more likely to respond to a senior nurse (Cherry and Jones 2015).

The literature suggests that nurses' educational preparation and clinical experience have the potential to influence patient outcomes. Education, particularly that which focused on the deteriorating patient, has a positive effect on the learner, which influences patient and organisational system outcomes. Despite the importance of deteriorating patient education in nursing curricula, culture and structural systems are aspects of the organisational hierarchy which have an impact upon nurse agency.

2.4.2 Calling for help

Nurses act as conduits of care in a climate of complex uncertainty in terms of resources, and clinician turnover (Idema and Manidis 2013), and operate and within role boundaries that require constant renegotiation. Once ward nurses have identified deterioration through the assessment of the patient an

assumption is that they would refer to others for more expert clinical assistance, but the literature shows that reporting deterioration is a highly complex process that is not undertaken lightly (Odell 2009), and which may lead to nurses questioning the validity of their decisions (Cioffi 2000b). Nurses may delay seeking assistance while they check with colleagues due to uncertainty as to how to articulate their concerns (Andrews and Waterman 2005). Also, it is recognised that nurses have difficulty communicating their concerns to medical staff, or in convincing them of the urgency of the problem (Andrews and Waterman 2005). Thus, patient deterioration systems such as the MET or ADDS aim to improve communication between disciplines by enabling nurses to convey objective concerns about the patient's condition (Hodgetts, Kenward et al. 2002, Missen, Porter et al. 2017).

2.4.2.1 Nurses agency in communicating vital signs

Despite increased emphasis on clinician accountability to improve healthcare (Rihari-Thomas, DiGiacomo et al. 2017), nurses' status in hospital hierarchy, workplace and organisational structures may impede their agency, particularly their ability to make decisions about taking and responding to abnormal vital signs. Socio-cultural and political barriers between professional groups may be preventing nurses from seeking assistance, even when a patient fulfils the criteria for the activation of a MET or ADDS response.

Inter-occupational interaction in health care is characterised by issues of legitimacy, power, and conflict within a culture of secrecy, fear and autocratic leadership (Mackintosh and Sandall 2010). As has been previously reported, unequal relationships exist in the everyday practices of healthcare work and boundaries require constant renegotiation. It has also been reported that 'lower level actors are often repositories of critical information', yet are

'unable to persuade higher-ups in the organisation of either the credibility of their knowledge or relevance to their perspectives' (Silbey 2009, p.361), making the act of communication difficult (Bell, Michalec et al. 2014). A nurse alerted to a patient who is deteriorating will refer the patient to a junior doctor who may then need to call for assistance from a more senior doctor which leads to delays in response.

Referring vital sign changes is a highly complex process (Odell 2009), and nurses can delay activating a response system due to uncertainty (Odell, Gerber et al. 2010). Indeed, nurses find it hard to put their tacit understanding of patients' condition into words (Douw, Schoonhoven et al. 2015), which may further delay calling for assistance. Quantifiable evidence, such as vital signs, was found to be the most effective means of referring patients to doctors, but support strategies need to be in place to develop 'medical language to empower nurses' (Andrews and Waterman 2005, p.473), as doctors did not accept subtle indicators (cues or subjective data) as evidence of deterioration, instead needing more convincing objective evidence, such as vital signs

To better understand how nurses communicate patient deterioration, Andrews and Waterman (2005) interviewed nurses (n=30), doctors (n=7) and healthcare workers (n=7) in a medical and surgical ward in a single centre finding that nurses used credible evidence to communicate their findings. Thematic codes were identified whereby nurses used 'intuitive knowing', 'contextualising' and 'grabbing attention' so that doctors would review a patient's condition. Doctors, for their part, used quantifiable evidence in terms of 'packaging deterioration' to judge how ill patients were (Andrews and Waterman 2005), and required convincing evidence of deterioration. Vital signs were used to confirm what nurses suspected on the basis of experience or of seeing that someone looked unwell, and they provided an

unambiguous, convincing referral language because they are readily understood. In the study, nurses reported using vital signs as 'attention grabbers' to get the attention of doctors rather than using difficult to describe, subjective language. Further, Andrews and Waterman (2005) suggest that the use of subjective language to communicate deterioration may make nurses appear inarticulate.

Andrews and Waterman (2005) found that nurses required support to cross the hierarchical barriers that exist in health care (nurse to nurse, nurse to doctor, nurse to consultant), but that more experienced nurses were prepared to take action in situations they judged as warranting immediate intervention (Andrews and Waterman 2005). This relates to nurses' capacity to express their agency. Less experienced nurses however were more likely to face communication problems when seeking medical help for deteriorating patients (Mok, Wang et al. 2015). To bridge the gap between detecting deterioration and communicating it clinically, Andrews and Waterman encouraged organisations to adopt a standardised process for hand-over of care between health professionals.

Communication between health professionals occurs in different ways, with members of each field trained in their own styles. When communicating between disciplines, nurses are expected to be highly descriptive, whereas physicians are trained to be succinct in communicating patient details (Foronda, MacWilliams et al. 2016). This results in tension between the professions, and may lead to opportunities to respond to patient deterioration being missed (Garling 2008). To address communication issues structured approaches were developed to facilitate the conveying of deteriorating patients' details with the most commonly adopted being variants of the ISOBAR (Identification, Situation, Observations, Background, Assessment and Action, Response/Responsibility) tool (ACSQHC2009).

Communication skills are most likely to be rehearsed during simulated deteriorating patient education training (Connell, Endacott et al. 2016).

Documentation of vital signs is another important communication process used by nurses, and the format of the chart on which vital signs are recorded has undergone significant change. In Australia a standardised chart (ACSQHC 2010) for recording and responding to abnormal vital signs was developed using human factor design principles and incorporating decision support characteristics to improve the detection of and response to abnormal vital signs (Elliott, McKinley et al. 2014). The charts include colour-coded zones that indicate when vital signs deviate from pre-determined normal values. The zones on the chart are linked to actions, becoming more urgent as the vital signs become more abnormal (Elliott, Allen et al. 2015). Although standardised, healthcare organisations' have been encouraged to adapt the chart to suit their local requirements (ACSQHC 2010). An online survey of health professionals (n=347) found that chart users preferences for design features were not always consistent with objective performance data and that experienced nurses were unfamiliar with some of the assumed knowledge required to interpret charts (Preece, Hill et al. 2012). More recently, a survey of clinical user experiences and views following implementation of the standardised charts was conducted with 44 focus groups (n=218) finding significant tensions between chart aims and clinical practices with objective results showing that charts were not used to their optimal design function (Elliott, Allen et al. 2015). The key emergent themes were: tensions between vital sign 'range versus precision' to support decision-making; using a standardised chart in specialist areas; issues of 'clinical credibility'; 'professional autonomy' and 'influences of doctors' when communicating abnormal vital signs, and; 'permission and autonomy' when escalating care according to the protocol (Elliott, Allen et al. 2015). The review further supported the idea that organisational work-based cultures,

disciplinary boundaries and interdisciplinary communication, and the practice of vital sign documentation and management are significant influences.

The National Institute for Health Care Excellence (NICE 2007) recommends that vital signs should be monitored at least once every twelve hours, with the frequency to be increased if abnormality is detected. A large single centre study in the United Kingdom found that only 13 per cent of the 950,000 vital sign records studied were taken between 2300 and 0559, indicating that vital sign measurement is also related to time of day. Even for patients who had been identified through vital sign scoring as warranting an increase in vital sign measurement, only 57 per cent had a vital sign documented between midnight and 0559 (Hands, Reid et al. 2013). Regardless of standardised protocols for vital sign measurement, compliance with protocols remains problematic particularly overnight (Griffiths, Saucedo et al. 2015) as nurses appear to prioritise rest over monitoring.

The literature reveals problems with collection of vital signs, communication of changes, the language used to communicate with medical professionals, and with vital sign documentation. Amongst the works reviewed, the reliability and validity of the evidence is varied due to differing methodologies and small sample sizes. As suggested in the literature, nurses' agency in taking, recording and making decisions about vital signs remains problematic.

2.4.3 Nurses collective agency and the deteriorating person

A defining characteristic of the professional is said to be the possession of a unique body of knowledge, which, alongside expert judgement and patient ethics, leads to autonomy in decision-making (Traynor, Boland et al. 2010). Doctors have full professional status due to their exclusive theoretical

knowledge, which shapes and challenges health care communication (Rihari-Thomas, DiGiacomo et al. 2017). Their elevated organisational status enables them to have a degree of control and power over nurses who, in the hospital hierarchy, have subordinate status (Churchman and Doherty 2010). Professional boundaries are determined by the hierarchical organisation of the hospital, and nurses find it difficult to expand their jurisdictional boundaries, instead developing a shared collective identity distinct from that of doctors

Stein et al. (1990) argued that with societal changes, including an increased number of female doctors and degree-educated nurses, the doctor–nurse relationship was no longer characterised by domination and subordination, but was rather one of mutual interdependence (Stein, Watts et al. 1990). Chiarella (2002), however, maintains that it is a misperception of the professional status of the nurse due to clinical dominance by medicine which renders nurses confused over their professional responsibilities in relation to patient care. This is most evident in the interplay of communication approaches used by nurses to seek medical assistance for patients in their care. Churchman and Doherty (2010) interviewed 12 female nurses in a qualitative study to explore the extent to which they were willing to challenge doctors' practice in everyday situations in an acute National Health Service hospital. The results showed that nurses used 'battle metaphors' to describe how they felt they needed to prepare and protect themselves from the possible threat of psychological injury when questioning doctors' practice. In addition, nurses spoke of 'playing the game' by making subtle suggestions which appeared to be initiated by the doctors in order to achieve what they felt were appropriate outcomes for the patient. If hospital policies were available to support the nurse, then the nurse felt more confident to challenge the doctor. Though a small, single centre study, which may reflect only the culture of the participating hospital, this research indicates that structural inequalities are barriers to nurses working in close partnership

alongside medicine. The professional boundaries between doctors and nurses may help to explain the limitations of effective relationship building, and could be contributing to nurses' lack of agency.

Returning to Chiarella's (2002) assertions that nurses are confused regarding their professional responsibilities, this is mostly explicable by a lack of autonomy in decisions regarding patient care. Professional autonomy means having the authority to make decisions and the freedom to act in accordance with a professional knowledge base (Skar 2010). Significantly, control over the field of work is a characteristic of the autonomous professional (Traynor, Boland et al. 2010). Work in health care can be understood as a combination of technically definable activity and the formation of professional judgement or clinical decision-making, which, in nursing, combines evidence-based practice with intuitive approaches to care (Traynor, Boland et al. 2010). Clinical decision-making that relies on intuition may be at odds with organisational demands for standardisation, such as an adult deterioration detection response system (ADDS), and with accountability, as it is in conflict with 'more rationally defensible [evidence-based] decision-making' (Traynor, Boland et al. 2010, p.1585).

Whilst ward nurses can monitor and detect signs and symptoms of deterioration through vital signs, it is possible to misinterpret or miss them (Odell 2010). The decision-making process of nurses in the pre-arrest period was studied, uncovering a number of cues and factors employed by nurses to identify and interrupt potentially preventable adverse events (Gazarian, Henneman et al. 2010). Using a qualitative descriptive study, the authors reviewed the nurse decision-making process with 14 participants who had experience with patients in pre-arrest events. The nurses had a mean experience level of 8.5 years, and were considered 'competent' in identifying patient deterioration and activating the RRS. The study sought to locate the

cues nurses used to identify that a patient is at risk of an adverse event and the factors that influenced the decision to interrupt an adverse event. Interview data were analysed using cognitive task analysis of preparation, data structuring, discovering meanings, and representing findings. Key themes and cues were revealed through structured analysis (Gazarian, Henneman et al. 2010). Results which interrupted an adverse event were associated with the experience of the nurse in prearrest situations, and with the importance of the organisational support processes that were in place. These processes enabled the nurse to monitor the patient, facilitated working in teams, and provided access to knowledge resources.

The literature has shown that trends and patterns facilitate decision-making processes which are influenced by previous knowledge and experience and are built up over time. A systematic review to identify the signs and symptoms that trigger nurses' response to deterioration was undertaken by Douw and colleagues (2015), who found that 'worry or concern' was present before changes in vital signs, suggesting the possibility of improving care in early stages of deterioration. Subjective signs included changes in breathing, changes in circulation (colour, and/or clammy skin, arrhythmia), temperature (rigour, fever, or hypothermia) change in mentation, agitation, pain, no progress (abdominal distension, nausea, bleeding, hypoglycaemia), change in behaviour or 'does not look good', gut feeling, and/or knowing something is wrong (Douw, Schoonhoven et al. 2015). Detection of all of these subjective cues was not reliant on traditional vital signs.

If nurses are not relying on vital signs to determine deterioration, this may, in part, justify delegation of vital signs to others. However, a paradox exists if nurses place value upon the frequent measurement of vital signs yet delegate this highly valued task to others (Burchill, Anderson et al. 2015). This requires further investigation. If nurses make decisions based on their knowledge of

the patient and on pattern recognition to detect deterioration, it may follow that they would remain sceptical about deterioration if it was only detected through the measurement of vital signs.

2.4.4 Nurses' agency in the context of ward work

The hospital setting in which vital signs are measured has changed. It has become increasingly complex, and patient populations and patterns of work have altered. Much has been written about the nursing workload (Aiken, Clarke et al. 2002), including its impact on patient mortality, and on the barriers it presents to rapid response system activation (Hill 2017, Rihari-Thomas, DiGiacomo et al. 2017), but its relationship to the quality of vital sign assessment remains unclear. Workload is influenced by a range of factors, including the amount and type of nursing resources needed to care for each patient, as well as patient case mix and complexity (Schubert, Glass et al. 2008). Patients admitted to acute care hospitals are sicker than in the past as they have more complex health problems and are far more likely to become seriously ill during their stay (Ryan, Cadman et al. 2004). This necessitates closer attention to patient assessment, and therefore to vital sign measurement and analysis. The role that vital signs play in nursing care has been explored from a national and international perspective.

Mok and colleagues (2015) undertook an integrative literature review to explore factors influencing ward nursing practice of vital signs monitoring in detecting and reporting deterioration. They reviewed 20 papers and used three sets of variables. The *patient variables* included signs of deterioration such as physical cues and abnormal vital signs. *Nursing variables* included clinical knowledge, roles and responsibilities, and reporting of deteriorating signs. Finally, *organisational variables* included heavy workload, technology, and observation chart design. The results showed that myriad factors affect

ward practice of vital sign monitoring in detecting and reporting deterioration. These factors included: nurses overlooking the significance of vital signs, and thus often delegating their assessment to nurses with less experience; the essential importance of effective communication between nurses to convey deterioration; the contentiousness of the workload effect and its impact on vital sign monitoring, and; technology compromising the quality of patient assessment. Further research is necessary to understand the attitudes of nurses to all of these factors (Mok, Wang et al. 2015).

Nurses' work processes and workspaces must be designed to maximise efficiency, and to make them less conducive to the omission of care, and more amenable to the detection and remedying of problems when they occur (Child 2004). One aspect of these work processes to be redesigned is nurses' work hours, whether rotating shift work or the number of days off between scheduled shifts, each of which contributes to feelings of fatigue and to increased error rates (Child 2004). A number of studies provide evidence that nurses spend a significant proportion of their time on activities that are inefficient and which thus disproportionately decrease the amount of time available for monitoring patient status (Aiken, Clarke et al. 2002, Tucker and Edmondson 2003, Tucker and Spear 2006, Kalisch and Aebersold 2010). A survey of half the nurses in California, showed that 34.3 per cent of nurses perform housekeeping duties, 42.5 per cent deliver and retrieve food trays and 45.7 per cent transport patients. Of these same nurses, 27.9 per cent reported leaving patient education and preparation for discharge undone (Aiken, Clarke et al. 2002). Tucker and Edmonson (2003) reported that nurses faced an average of one work design problem per hour in five broad categories of work problems, including, for example, absent or incorrect information, missing or broken equipment, waiting for a (human or equipment) resource, missing or incorrect supplies, and simultaneous demands on their time. During the observational study, 39 per cent of the

work problems caused on average, a 90 minute delay in patient care (Tucker and Edmondson 2003).

2.4.5 Section summary

It is suggested that as a consequence of nurses aiming to meet ever-increasing demands, performing vital signs has lost its priority, instead being delegated to others to perform (Wheatley 2006). This is supported by the National Patient Safety Agency in the United Kingdom (2007) which reported that recording vital signs was seen as a task that needed to be completed, but given that most patients have normal results, a degree of complacency exists. Delegation of vital signs to others, particularly those with less experience, has the potential to detract from nurses' recognition of deterioration in patients, due to a lack of exposure to the variety of physiological changes (Fasolino and Verdin 2015). This means that the significance of vital signs in detecting deterioration is often overlooked by nurses (Mok, Wang et al. 2015). It is difficult to interpret why deterioration is overlooked, though much of the work on nursing surveillance (collecting, analysing and interpreting information) (Fasolino and Verdin 2015) has occurred through retrospective audits of nursing documentation (Odell 2014), with other methods of data generation, such as interview or observation, tending to be smaller in terms of the number of hours or size of population studied.

2.5 Chapter summary

This chapter has critically reviewed research literature related to vital signs and the deteriorating patient. The review highlighted the significance of the problem, as well as the use of vital signs as an objective measure of patient health status. Nationally and internationally, vital signs have been significant in the research and practice literature. The Australian Commission on Safety

and Quality in Health Care has released guidelines on the deteriorating patient (ACSQHC 2011), and in addition that the state and federal Health Ministers of Australia have endorsed the National Safety and Quality Health Service Standards (NSQHS), which include an accreditation process to be met by acute care hospitals. Standard 9: Recognising and Responding to Clinical Deterioration in Acute Health Care (ACSQHC 2012, ACSQHC 2017) was identified as the most relevant in terms of setting the standard and criterion for organisational governance of vital signs. On the basis of the Standards, acute care hospitals have implemented policies and procedures to assist health care providers in areas such as measurement and documentation of vital signs, escalation of care, establishment of rapid response systems, and, finally, communication about clinical deterioration.

This review has revealed that despite organisational structures such as the requirement to meet national standards, initiation of escalation of care procedures, structured communication processes, and rapid response systems, acute undetected or mismanaged deterioration in acute care hospitals continues to occur. Also, the review showed that not all vital signs are predictive of clinical outcome, and may in fact provide only limited information about the status of the patient. As nurses are exposed to variations in vital signs in their practice, their use may be fallible for the purpose of validating physiological deterioration, which may partly explain their omission in procurement or communication structures. In addition, the literature implies that culture plays a role in hospital wards, in that nurses on medical and surgical wards who depend on technology rather than on physical assessment skills may make more errors or oversights with respect to vital signs. Nurses also use intuition and visible cues of the patient becoming unwell, or recognition of patterns based on knowing the patient and the context in which the health care is taking place. Vital sign assessment is used to report changes in the health status of a patient as an attention seeking activity to obtain assistance for the patient. The reliance on vital signs to

communicate with doctors, in contrast to communicating a more detailed health assessment, may be being sustained through the use of existing early warning systems which do not call for detailed patient assessment and instead support the reliance on vital signs to detect changes in a patient's condition.

The use of technology limits the contact that nurses have with patients and has been viewed as a barrier to the use of nursing assessment skills as minimal sensory cues are collected. Education about the deteriorating patient is clearly a theme of the literature, but only a small number of studies have been shown to improve and sustain the recognition and response process through vital sign measurements. Focusing on the examination of the incidence of adverse events and their consequences may shift the emphasis away from the importance of organisational and systemic conditions that lead to adverse events, such as physiological deterioration that goes unrecognised or unaddressed. The literature highlights the central role of the nurse in the assessment performed, which includes the taking, recording, interpretation and use of vital signs, and of the nurse's level of experience. Less is known or understood about nurses' knowledge, understanding and practices in relation to the monitoring of vital signs in the context of a busy ward environment. In spite of the breadth of the existing literature in this important area of nursing research, the importance nurses place on vital sign measurement and how they use it in clinical practice remains unclear.

Increasingly, hospitals are recognised as complex structural systems that do not follow linear cause and effect models of care (Iwashyna and Amaral 2014). There is also incomplete understanding of why systems to address physiological deterioration may or may not work. Exploring how organisational and structural factors influence nurses' engagement with vital signs will assist in identifying generative mechanisms. The literature is

relatively sparse on the subject of nurses' agency, especially in terms of how nurses enact vital sign decision-making within medical and surgical wards, and particularly from a perspective that critically examines factors that influence agency. Where decision-making *is* noted, the research has not critically addressed structures or the influence of generative mechanisms relevant to nurses' vital sign agency, particularly in relation to professional boundaries and how nurses act within differential power relationships. The interplay of power in acute care hospitals is significant to the study of nurse agency, and, little has been explored in terms of this on nurses vital sign practices. Much of the research has taken the form of retrospective chart audits or small scale studies, thus missing opportunities to explore the reality of nurses' vital sign practices. Filling these gaps will add to the body of deteriorating patient research, and will offer critical theoretical insight into vital sign practices.

The next chapter introduces the research design, and the research methods and methodology used to address the research questions.

Chapter 3 Research design

> The critical realist search for causation assists to explain social events and suggest practical strategies to address social problems (Fletcher 2016).

Every day in acute care hospital settings, nurses practice in complex and dynamic situations. The previous chapters have shown that practice occurs in a richly contextual social world, where unwritten (and sometimes competing) rules may apply. In this setting, a patient's health may deteriorate unexpectedly, and such changes may manifest themselves in their vital signs. These signs may or may not be acted upon by the nurse, which can result in their missing an opportunity to detect and address patient deterioration. The factors that cause nurses to act (or not) on vital signs have not been fully captured, and the previous chapter drew attention to the gaps in the deteriorating patient literature, and also guided the reader as to the need for a critical perspective. This perspective is needed to describe acute care nurses' vital sign practices, and to explore how agency, structure and cultural factors influence these practices. Critical realism provided a theoretical framework suitable for investigating the interplay between nurses' agency and vital signs, in order to explain the experiences and perspectives that influenced behaviour.

Critical realism as applied to this study involved understanding how factors in the individual and in the workplace setting interacted to causally influence key behaviours in nursing practice. Mixing qualitative approaches (using expansion and elaboration through observation and key informant interview in a theoretical framework of critical realism) helped to explain the generative mechanisms which produced vital sign practices in surgical and medical wards in an acute care hospital setting.

The way we perceive the world (ontology) influences what we believe can be known (epistemology), as well as the way we investigate problems. This chapter describes the methods and methodology used to answer the research questions: combining ethnographic procedures of observation with key informant interviews within a critical realist framework. The method was important to exposing, understanding and explaining nurse agency, structural factors and generative mechanisms. Observation and key informant interviews were necessary, as they provided a perspective on the reality for the nurse in terms of identifying events which may (or may not) have led them to take action. Observation and interviews were also undertaken to identify aspects of workplace culture that influence nurses' vital sign practices. This process gives voice to the participants in their own context, generating verbatim quotations and rich descriptions of events (Fetterman 2010). Data analysis involved abduction and retroduction, whereby observation and interview data were combined to facilitate the identification of themes for analysis.

In this chapter, the research methods and design are detailed and justified. The research setting is described, and the rationale for selecting each method provided. A conceptual map is included to guide the reader through the research design. The participants are introduced, and the environment in which vital signs were used in practice is identified. Issues related to ethical practices and research rigour are addressed for each phase of the study.

3.1 A critical realist framework

The practice context is a multilayered construct which brings together issues of culture, leadership, behaviour and relationships. This thesis draws on insights from critical realist methodology, which offers a theoretical approach that covers a 'wide and rich terrain' (Mingers 2004, p.152), in order to understand and explain causal relationships and important contextual influences. Causation reflects the observed and experienced events generated in complex interactions. Changes that occur, which may be physical, social or conceptual, are a result of 'the interaction of relatively enduring mechanisms that have particular properties or powers' (Mingers 2017, p.175). Critical realism was used to locate causal (generative) mechanisms and to explain their power to influence nurses' agency by exploring reality from the perspectives of people, structure and culture. Nurses, their world, and how they reflected upon that world were important to the study. Structural elements, powerful drivers in contouring behaviour, were captured and explained in the culture and context of practice.

Agency and structure are interrelated, and are studied according to how the interplay between their respective properties and powers can explain the outcome of either or both (Archer 2003, p.44). Nursing work is complex by nature, difficult to articulate, and often hidden from view. Events in practice either happen or not through the interaction of a variety of generative mechanisms. As an example, the literature review revealed that nursing practice is undertaken in the context of divisions of labour, which requires management of bureaucratic hierarchical boundaries, which are themselves located amongst organisational rules and policies. Critical realism offers the chance to understand how nurses interacted with vital signs, professional boundaries, and organisational systems with their embedded requirements and rules for vital sign measurement and mandated responses, each of which shaped jurisdictions, cultural norms and structural power.

As a methodology, critical realism is interpretive and critical, starting from questions about what exists. Having identified this, it moves to focus on questioning the creation of knowledge about that existence (Bergin, Wells et al. 2008). For the study, critical realism explains the interplay between the actions of nurses (agency) and the structures (social organisation, culture and relationships) which have 'their own powers, tendencies and potentials' (Archer 1995, p.110). Individuals have the power to make decisions, but these decisions may be constrained by structural factors – how these constraints operate is dependent on what specifically they are held to be.

Archer (2003) sees structure and agency as ontologically distinct elements of reality, though they have different properties and powers, and the interplay between the two is worthy of examination. Archer (2003) advises that structural factors which arise from the socio-cultural context may impinge upon the actions of agents. Agents, however, are capable of modifying their intentions in light of their perceptions of the changing context, making their intentions 'neither uniform, nor static, nor passive' (Archer 2003, p.134). Agency in this sense is mediated by reflexive deliberation, which constitutes a personal power or capacity (Archer 2007) that operates from within practical experience of the context in which practice takes place. Reflexive deliberation, according to Archer (2010, 2012), has a variety of modes (communicative, autonomous, meta-reflexive and fractured reflexive), which may assist to explain why a nurse acts in one way rather than another within the same socio-cultural context.

This study takes a sequential qualitative approach of observation and interview to explain the nature of the stratified reality and the meanings this generates. The factors which generate the practice of vital signs in the setting of complex hospital wards are explained as and when they facilitate or undermine the interaction between nurses and vital signs. This is done by

exploring nurses' experiences in order to expose knowledge of deeper realities (structures and events), to reveal these structures that produce and reproduce events. In particular, an explanation of the powers that constrain or enable nurses' agency and how they themselves interpret these, is sought.

3.1.1 Structure and agency

Critical realism argues that social reality incorporates structures and mechanisms that bring about events that shape experience (Khan, Qualter et al. 2012) through the interplay of social structure and human agency (Archer 2003, Kontos, Miller et al. 2011). For this study, it was necessary to explain socio-cultural structure, individual and collective agency through engagement with nurses within the complex context of their work environment. Agency, as the capacity of the nurse to act independently and to exercise choice, alongside the structures of patterned arrangements in the hospital wards, such as cultural norms and institutions (Kontos, Miller et al. 2011), needed to be understood in order to explain the mechanisms which influenced nurses' agency.

Structures predate the context in which they occur, and therefore have a history, which in turn has a relationship with the current circumstances, as well as those in the future. In Chapter Two, structures were identified in the domains of material, physical and human aspects, such as the roles of health care professionals. Also, the previous two chapters have shown that nurses practice in complex settings. They enter into these settings with their own history in the world, and with their own experiences of patients and their vital signs. The hospital ward, too, has a socio-cultural history, which reflects the everyday structures that nurses practice within. Nurses work alongside other agents who also have their own histories and agential powers. The doctor–nurse power dynamic has also been raised throughout the literature

review, and forms a structural element which may also contribute to shaping nurses' agency.

To properly address the 'why' questions in the study, it is important to first acknowledge causality and to recognise that human agency informed by meaning is part of the causal nexus. For nurses in hospital wards, their interaction with vital signs is produced and reproduced through structures which may pre-date them. This means that the structures, which the nurses themselves did not produce, are enduring and independent of the people in hospital. Structures are therefore real, pre-date agency, and are independent from agency. However, these things are ontologically interdependent, and require triggering by particular circumstances or interactions (Mingers and Standing 2017) to have an objective effect on situations, whether they cause action or not.

Archer (2003) argues that a process of mediation influences the effects of structure on agency. Archer suggests that three stages are important for agency. The first is that structural and cultural factors objectively shape situations which agents confront involuntarily, and possess generative powers of constraint or enablement. Secondly, agents' have their own configurations of concerns, as subjectively defined by nature, practice and society. Thirdly and finally, courses of action are produced through the reflexive deliberation of agents who subjectively determine their actions in relation to their objective circumstances (Archer 2003, p.135). The power of agents, therefore is exercised through a process of reflexive monitoring (Bhaskar 1989), which is an internal dialogue with oneself (Archer 2003) in which beliefs and concerns are clarified in order to construct schemes for future action (Kontos, Miller et al. 2011). Thus, the role of subjective and objective dimensions by which cultural and structural factors shape the concerns a person holds and the possibilities for action is stressed.

External conversations with and in the presence of other participants, in which expectations, goals and projects are contextually negotiated, are also important as an activity of social construction (Caetano 2015). Nursing decisions, mediated internally and externally, are filtered by the context of interaction, which is dependent upon numerous factors outside the control of the agent. Here, the generative mechanisms are contingent upon structure and upon socio-cultural contexts.

3.1.2 A stratified reality

In a health care setting, practice provides the primary domain for nurses' action. Objectively, in terms of vital sign practices, a nurse may wrap a blood pressure cuff around a patient's arm, but we cannot know why that action was taken, nor what the nurse was thinking at the time. Archer (2000) argues that practical knowledge, embodied through skills, is tacit in nature, and is incorporated into activity and the associated use of artefacts, which themselves require the development of further skills. To reach an understanding of nurses' vital sign practice, a way of tapping into their reality was needed, as practical knowledge usually 'escapes our conversation about it, given its performative role in relation to the natural order of the physical environment' (Archer 2000, p.166) – all of which occurs within complex socio-cultural settings with their own causal powers. Causal powers which generate or constrain agency exist within a stratified domain, and may be mediated by inner conversations (reflexivity).

For the critical realist, reality is ontologically stratified into three layers: the *empirical*, the *actual*, and the *real* (Bhaskar 1975). The *empirical* domain contains human perspectives of the world (Clark 2010), meaning observable experiences. The *actual* domain contains events and outcomes that occur in the world. Lastly, the *real* domain contains underlying relations, structures

and tendencies that have the power to cause changes in the *actual*. Most of the causal influences remain dormant, but under the right circumstances, factors in the *real* domain can act together to generate causal changes in the *actual*.

This research seeks to expose and explore the gap between what nurses experience and understand in their vital sign practices (the *actual* domain) and what is really happening (the *real* domain), whilst identifying the generative mechanisms in play, which are activated in the *real* domain, and, importantly, identifying how these mechanisms shape vital sign practices.

3.1.3 Culture

Structure and agency cannot be discussed without acknowledging the influence of socially constructed elements of culture. By examining the intersubjective nature of reality, and the way that meaning is constructed, we come to understand how people and cultures create a world of meaning, and the implications that this has for how nursing practice is approached. Brown and McCormack (2011) define culture as 'the way things are done around here'. Culture, for the purposes of this research, is established from the habits, prevailing attitudes, and accepted behaviours of members of the organisation, in which health care is delivered (Braithwaite, Greenfield et al. 2010, Brown and McCormack 2011).

Culture, which represents 'the shared perceptions, values and meaning making that people employ to co-construct their organisational world' (Braithwaite, Greenfield et al. 2010, p.7), is developed through group socialisation and learning (Wilson, McCormack et al. 2005). Culture encompasses 'the sum total of enacted behaviours, meanings and attitudes'

of people operating within a range of complex variables (Braithwaite, Greenfield, Westbrook 2010, p.8). Culture, as a fluid, dynamic entity, is the means by which we obtain, synthesise and enact our particular experiences. People are not passive recipients of culture instead they play an active role in making and remaking culture. Archer (1995) divides structure into the two realms of structure and culture, which Case sees as interconnected with agency (Case 2015). There is always an interplay between structure (culture) and agency (selfhood), according to Rosaldo (1989). Exploring the cultural influences on nurses' vital sign practices in acute care hospital wards was required to explain the generative mechanisms of culture in the *real* domain.

3.1.4 Generative mechanisms

The central idea of causation in critical realism is that events that occur do so as a result of the interaction between relatively enduring mechanisms that have particular properties or causal powers (Mingers and Standing 2017). Mechanisms have a number of characteristics, in that they exist in a real, ontological sense independently of how they may be known or described by observers. They are stratified, in the sense of depth or hierarchy, and they may be physical, social or conceptual. They may be observable or un-observable in their effects, and they have enduring properties which may vary in timescale. This means that the effect of a generative mechanism may cause an effect many years later or instantaneously. As powers, generative mechanisms may not be exercised all of the time, perhaps needing to be triggered, or they may have no effect as they are counter-measured by another mechanism. As a structure they have inter-related parts together with the powers or tendencies of the structure (Mingers and Standing 2017). Agents themselves can reproduce and transform structures. A generative mechanism, however, may not always cause an action; part of Bhaskar's ontology suggests that reality consists just as much of absences as positive presences.

3.1.5 Morphostasis/morphogenesis

Society is activity-dependent, and is changed and reproduced through the activities of agents operating in conditions not of their own choosing (Archer 1995, Mutch 2017). Nurses, through their actions, change and reproduce practice, which, for Archer (1995), is mediated by reflexivity. Reproduction of society through the formulation of structure conditioning agency is termed morphostasis, whereas transformation is morphogenesis. Change occurs for agents and social structures in interlocking and temporally complex ways. Agents are formed within a set of social structures, and the agent's genesis occurs in the context of these structures. Structures also change as a result of the activities and choices of the historically situated agents, leading to formation and transformation (Archer 1995). Critical to this study is the relationship of these concepts to nursing practices. Explaining the 'norms' of practice will provide an account of actors' performance with the entailments of culture and structure.

3.1.6 Summary

Nurses practice in contexts which are multilayered, working within structures that may or may not affect their agency. What is required is a methodology that exposes potential generative (causal) mechanisms. Critical realism addresses the need to explain the events that occur in the context of practice by identifying the interplay between structures and agency. Agents' own configurations of concerns produce action through reflexive deliberation in relation to their own objective circumstances. The behaviour of a generative mechanism cannot be specified without considering its context; that is the other mechanisms that are also operating at the same or at different hierarchical levels. Some events experienced as mechanisms may or may not interact with each other. Critical realism as applied to this particular research

project involves understanding how factors interact to causally influence key behaviours in nurses' vital sign practice.

3.2 Research design and methods

This two-phased study used two qualitative methods in a sequential descriptive explanatory research design; one method of data collection was followed by another (Creswell and Plano Clark 2007). In using this approach, results from phase one (observation), which was exploratory in nature with a focus on the inductive, developed and informed the second, descriptive, explanatory phase (key informant interviews). The data were analysed thematically using a critical realist approach of abduction and retroduction, with the explanatory power of the causal mechanisms and structures contextualised, and relationships that may or may not exist explained (Danermark, Ekstrom et al. 2002).

Clinical practice can be understood as 'orderly chaos' (Walsh and Evans 2014), and a method of data collection was required which could capture the intricacies of a complex phenomenon more holistically by researching it from multiple perspectives. This is important when studying human beings, given our individual uniqueness and the ever-changing environment in which we live. Phase one used ethnographic methods, by which the researcher observed nurses in medical and surgical wards take, record and use vital signs as a component of their everyday work. Phase two comprised semi-structured interviews with nurses from medical and surgical wards. Specifically ethnographic methods of observation and analysis generated insight that fostered further development of concepts to inform the interview phase. Additional questions that arose from the observation phase were pursued in the interviews (Appendix 6). Engaging in meaningful conversation during interviews in order to understand participants' knowledge, views,

understandings, interpretations, experiences and interactions was ontologically important in clarifying the properties of reality within a critical realist approach.

Each phase of the study (see Figure 1, below) was designed to generate theory within a critical realist framework to capture the interrelationship between nurses and vital signs as they occurred in the complex world of clinical practice. Qualitative methods such as observation are often combined with interview to increase 'informational yield' (Tope, Chamberlain, Crowley, and Hodson 2005). Combining methods increased rigour, drawing on the strengths and minimising the weaknesses by incorporating both methods (Johnson and Onwuegbuzie 2004) as a way of answering complex research questions (Cresswell and Plano Clark 2007).

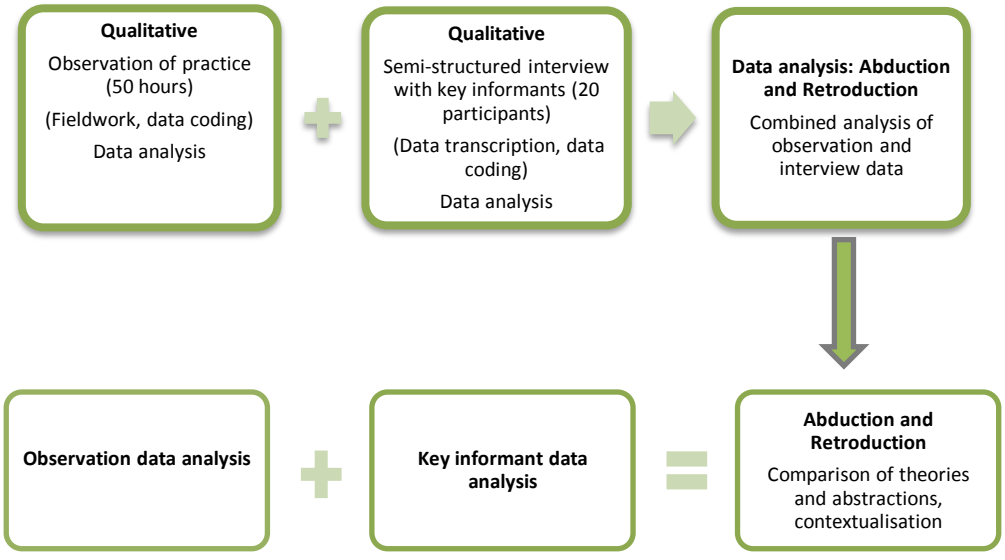

Figure 1 Research design

To understand nurses' agency, it was important, initially, to obtain evidence of their vital sign practices as performed on the clinical wards. This approach

aligns with the critical realist theory of reality as stratified into three overlapping domains (see Figure 2, below). Observation of nurses' experiences (which may or may not be directly observable) was important as it represents the *empirical* domain of reality. This domain comprises the experiences of structures (internally related physical and material objects/or human practices, or social systems) which have an effect (Sayer 2007) on their vital sign practice. The observation phase was also designed to observe nurses' actions, which are a result of what occurs when structural powers are activated. This is the domain of the *actual*. In exploring nurses' interaction with vital signs, their habits and patterns of practice were captured for later analysis to explain their behaviours. The final domain, the *real*, is where structures, powers and generative mechanisms are explained through the process of data retroduction.

The critical realist framework is an appropriate methodology to address the questions (see Figure 3, below) about nurses' vital sign practices, which, in the setting of acute care hospitals, reflect cultural, structural, relational and agential aspects of social life (Archer 1995).

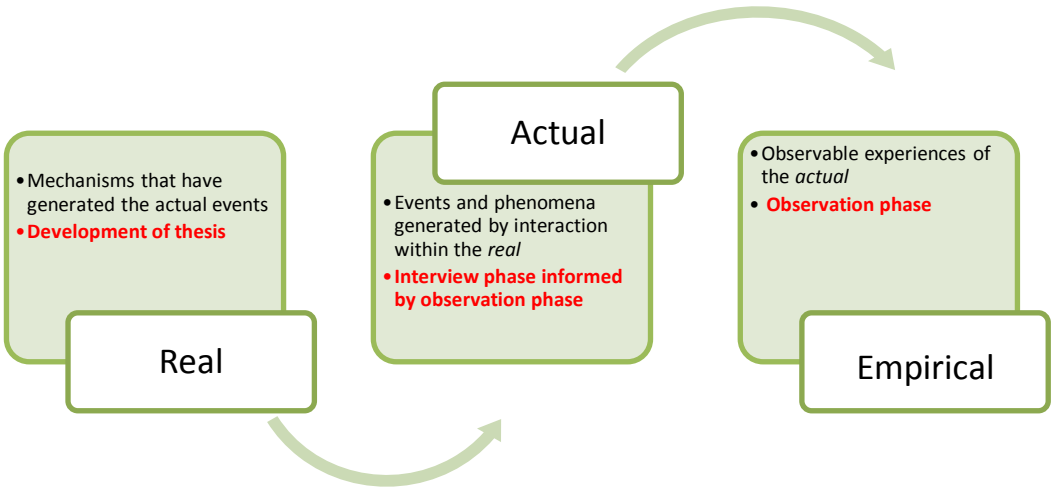

Figure 2 Critical realist framework and research design

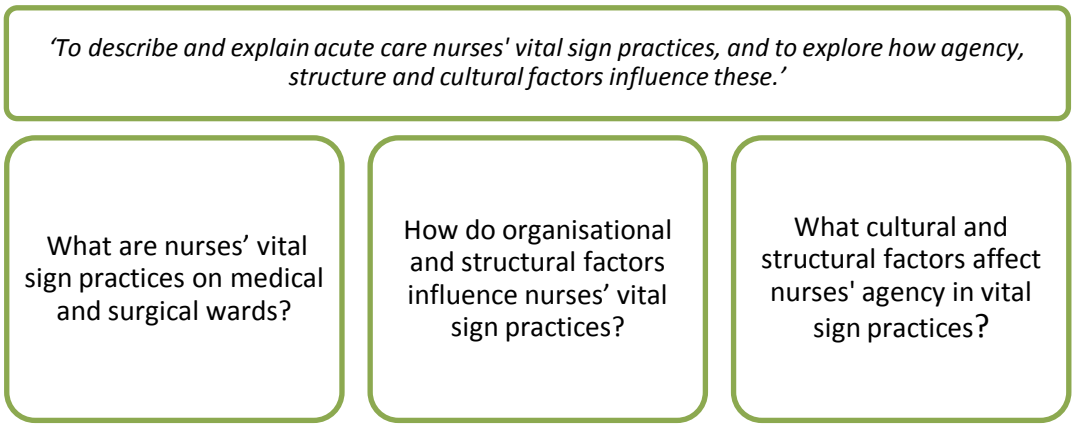

Figure 3 Research aim and questions

3.3 Site selection and recruitment

The criteria for site selection had to reflect the context in which vital signs are regularly taken, recorded and used by nurses. Surgical and medical wards were perceived as the most likely sites to fulfil these criteria, due to the nature of the population of patients requiring acute care. After approval from the Executive Director of Nursing (Appendix 1), the researcher approached key stakeholders, in this case Nurse Educators at a major tertiary referral hospital in, Australia. A formal written invitation (Appendix 2) was sent to Nurse Managers in surgical and medical wards, as they were the representatives of the sites where the majority of vital signs would be taken. Having received expressions of interest from two wards, the research took place in one medical and one surgical ward.

The Nurse Educators at each site facilitated access to potential research participants, for both phases of the study, by hosting informal meetings with the researcher during shift changes on the ward. This provided an opportunity for nurses to ask the researcher questions. Flyers (Appendix 3) were also displayed on ward notice boards, advertising the research and

calling for participants from among the ward nurses. Figure 4, below, identifies the key stages in accessing the research site and participants.

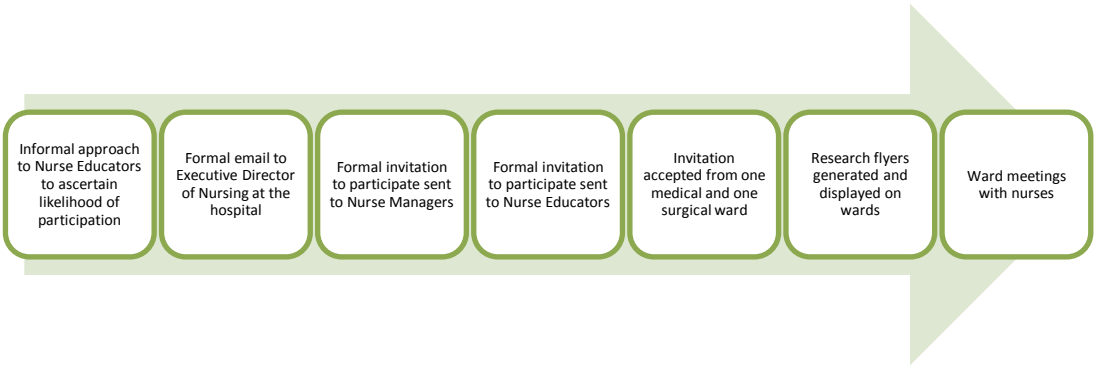

Figure 4 Process for accessing research sites

3.3.1 Research site

The hospital in which the research took place provides acute, subacute, mental health and aged care to a population of around 249,000. Beds number about 550, including 460 for acute overnight care and 90 day beds. Approximately 164 patients are admitted each day, with an average length of stay of just under two and a half days. At the time of the research there were around 2,190 fulltime-equivalent staff employed at the hospital, and a further 825 casual employees (DHHS 2012).

The medical ward was large and complexly laid out, consisting of three discrete areas: an acute stroke unit, a short stay medical admissions patient unit (MAPU) designed to alleviate bed blockage for patients awaiting medical ward admission, and, lastly, a general medical ward. There were 16 staffed beds divided into two sections in the MAPU, the area where the majority of ward observation took place. Each section in the MAPU had up to ten patients, cared for by two nurses. A Clinical Nurse Consultant worked on the morning shift as patient flow coordinator in a part-time capacity. Nurses with experience rotated through the MAPU from the other sections of the ward.

Enrolled nurses[1] comprised thirteen of the sixty nurses working on the medical ward, with the remainder being registered nurses[2]. Student nurses in their final year of education were on practice rotation during the observation period.

The surgical ward encompassed a busy mixed specialty ward with a nurse to patient ratio of 1:4 or 1:5, depending on the shift and patient acuity. The ward had a mix of registered (41), enrolled (two), and student nurses on their final year practice rotation (two to three) during the observation period. Each ward employed a team-based model of nursing care delivery, where small teams of two nurses worked with up to ten patients in a specific area of the ward. During morning shifts (0730–1600), seven nurses were rostered to care for patients, while four were rostered for the evening shift and two for the night.

Both wards had a racecourse-style layout, built around central hubs referred to as 'the main desk'. Single, double, or four-person rooms were the standard, which required nurses to physically enter the room to view a patient. On each ward, the machines to measure vital signs were located on portable stands in a central area. The machines were predominantly electronic, with one to two manual devices typically available per ward. A small number of patient rooms had wall-mounted manual machines located close to the bed, which, during observation, none of the nurses was seen to use. Figure 5, page 94, is a map of an example general ward layout. During

[1] In Australia an enrolled nurse (EN) completes an 18 month or 2 year course at diploma level. They provide care under the supervision (direct or indirect) of a registered nurse.

[2] In Australia a registered nurse completes a degree at University to achieve a Bachelor qualification. They have a higher level of accountability and responsibility than an EN.

observation, nurses moved between patient areas and the main office. The observation revealed that, on each shift, nurses would move vast distances to locate missing equipment (temperature probes, blood pressure machines, drug cupboard keys), as well as to prepare medications for administration.

The patient populations, despite differing clinical conditions, were surprisingly similar in terms of length of stay. Staffing ratios were also analogous. Each site experienced both planned and unplanned patient admissions. Data were collected over the course of the usual array of ward activities. The time and duration of each observation episode varied across a number of shift patterns in an attempt to capture the day-to-day activities of nursing on each ward.

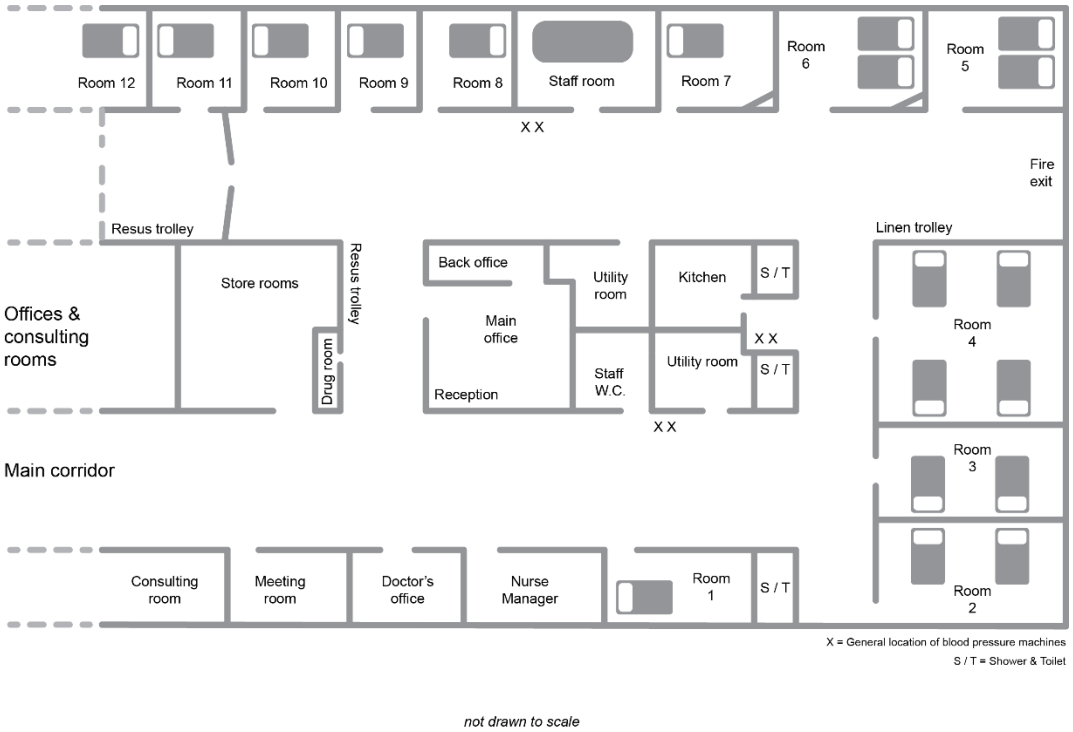

Figure 5 Ward Layout

3.3.2 Recruitment of the target population and theoretical sampling

'Nurses who took vital signs' were identified as eligible participants, and other than those who were studying in the university where the researcher worked, no one who wished to participate was excluded from the study. The majority of participants were female – 90 per cent of registered nurse graduates from a Bachelor of Nursing (registered as Division 1), were female (HWA 2014).

3.3.2.1 Observation phase participants

The Nurse Educators facilitated access to the nurses on the surgical and medical wards. Consent forms and participant information sheets were provided at the beginning of each observation period (Appendix 4). At each site, a usual work shift included registered, enrolled, and student nurses. The majority were female, and this is representative of the population studied. Only one nurse who agreed to the observation was an enrolled nurse; the remainder were registered nurses, with an occasional student of nursing captured in the observation process though not reported in the data. The experience level of the nurses ranged from newly graduated and in their first year of placement on a ward, to those with high levels of experience in the ward in which they worked. All nurses on each shift were invited to participate (excluding those identifying as undertaking study at the researcher's university), and those nurses who declined to be observed were not included.

3.3.2.2 Interview phase participants

The interview phase required key informants drawn from acute care settings to facilitate further data collection. A key informant needed to possess knowledge of the topic and to be expert by virtue of their involvement in vital sign practice. They needed to be able to reflect and provide detailed

experiential information in the subject area, and, most importantly, to be willing to share their experiences with the researcher. Nurses who 'had their finger on the pulse' and so could explain interesting observed behaviours to the researcher were identified as key informants.

Recruitment was facilitated by the Nurse Educators who were familiar with the research site and ward staff. General meetings with nurses were also conducted on medical and surgical wards by invitation of the Nurse Educators to provide an overview of the project; at these meetings, nurses were invited to contact the researcher should they wish to participate in an interview. The Nurse Educators also distributed written invitations to participate, and all nurses were invited with the same exclusion criteria as applied in the observation phase. An email containing the Participation Information Sheet and Consent form (Appendices 3 and 4) and a booking schedule was sent to consenting participants. Not all of the key informants who responded to the invitation were participants from the observation phase.

Following recruitment, simple demographic information was collected on each participant: years of experience at the research site, and whether they had completed post-graduate studies. Twenty nurses participated in interviews with the researcher, and, as is representative of the general demography of the nursing population, the majority were female. The average time spent working in the area of practice ranged from six months (12.5%) to more than 20 years (18.75%), with the majority of participants clustering around three to five years' work in their current clinical field (56%). In terms of post-graduate qualifications, 62 per cent of nurses had completed further studies, ranging from certificates in acute or critical care to Masters Degrees in Cardiology Nursing. Representative of the distributions at the two research sites, 37.5 per cent of participants were practicing in surgical wards,

while 37.5 per cent worked in medical wards. Nurses who were identified as being in a position of support to practicing nurses (by virtue of being either nurse educators or nurse managers) were also represented in the data at 37.5 per cent.

3.3.2.3 Sampling

The sample size for both the observation and interview phases was based on the concept of data saturation; when the researcher was no longer observing or hearing new information, she either withdrew from the field, or discontinued inviting other participants to be interviewed (Angrosino 2007). The observation phase captured a representative sample of the ward population: both registered and enrolled nurses. Enrolled nurses work under the supervision of a registered nurse and undertake less complex procedures. The majority of nurses observed were female and were registered nurses, which is representative of the target population.

In the interview phase, twenty nurses (19 registered nurses and 1 enrolled nurse) were recruited, representing novice nurses with minimal experience, senior nurses with extensive experience and clinical wisdom, and nurse managers, who were representative of those who had oversight of the clinical ward.

3.4 Observation phase

Observation included a pilot phase, a period of time in the field, and time 'dwelling in the data' to develop thematic codes. Unstructured questioning during observation was performed in an attempt to understand cultural practices. As suggested by Spradley (1979), observation necessitates a period

of focused attention by the researcher, which, over time, narrows to focus on deeper aspects of the context. Figure 6, below, illustrates how in-the-field observation occurred.

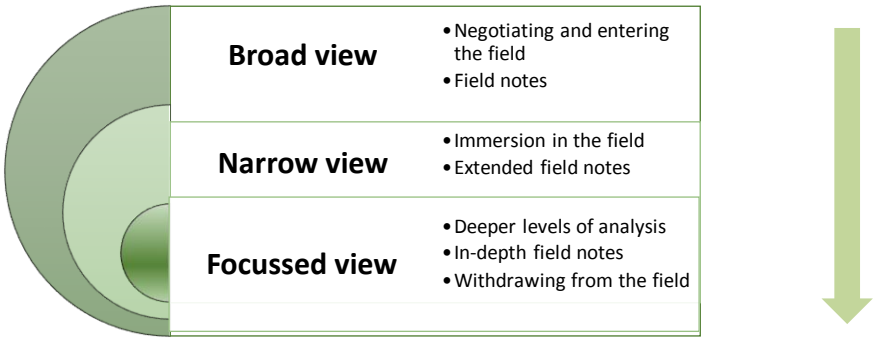

Figure 6 Observation process (adapted from Spradley 1979)

3.4.1 Justification for the field work

When studying nurses taking and using vital signs in a real-world setting, observation of clinical practice was necessary to gain an understanding of any structural or cultural influences that might exist. Spradley (1979, p.5) defines culture as the 'acquired knowledge that people use to interpret experiences and generate social behaviour'. To understand the culture of the clinical setting, it was necessary that the researcher experience the nurses' society by engaging in their day-to-day activities. To this end, the researcher engaged in opportunistic tearoom conversations, assisted with making beds, and joined in ward rounds with medical and nursing staff when invited to do so. Observation of nurses in clinical practice revealed to the researcher the 'taken for granted' aspects of vital sign practices through a semi-ethnographic methodology (Lofland, Snow et al. 2006).

Observation is the act of noting or perceiving the activities and interrelationships of a particular entity or group – in this case health care workers (meaning nurses, doctors and allied health professionals) – in the field through the researcher's senses (Angrosino 2007). The task of the researcher in this study, therefore, was to both describe and interpret all observed social actions, including behaviours within the study's particular context (Ponterotto 2006). The resulting expanded field notes, taken during observation, and the researcher's subsequent interpretation of the data were intended to draw the reader toward a 'sense of verisimilitude' whereby 'they can cognitively and emotively "place" themselves within the research context' (Ponterotto 2006). Thus, to gain appreciation of the participants' experiences and behaviours, field observation was appropriate.

3.4.2 Pilot study

Prior to engaging in formal data collection – and to enhance the observation process – the researcher spent a period of time on the wards, examining how nurses took vital signs. The Nurse Educators in the hospital facilitated access to the pilot site, which stood in for the research setting. The pilot allowed refinement of the observation process, and clarified the researcher's position in terms of data collection. Early immersion in field work allowed a deeper understanding of how group members' worlds were constructed and influenced by context (Boyle 1994, Holloway 2002).

3.4.3 Immersion in the field

Immersion in the wards involved a process of building a connection while maintaining a degree of distance so that the participants' natural behaviours could be observed. The researcher's presence was accepted quite early at each data collection site. The research journal captures this in the form of a

Clinical Nurse Specialist commenting on how completely the nurses on her ward accepted the researcher's presence; she was surprised that '*they ignored you at hand-over and just acted naturally as if you were not there*' (RN, Site 1, Obs 1). The researcher's early dilemma as to where to place herself during the site visits was quickly overcome by blending into the background during periods of inactivity. A natural, easy-going rapport was built with the research participants throughout the immersive fieldwork.

Transient connections were established by assisting with tasks such as bed-making, during which natural conversation occurred between researcher and participant. Non-participatory remoteness was maintained by the researcher carefully positioning herself at a distance from any patient–nurse interaction, and by refraining from interfering in natural behaviours. When undertaking observation it was important to establish a rapport between the researcher and the participants whilst also maintaining some degree of distance (Casey 2004). This is in keeping with the shifting role of the observer between 'insider' with the group and 'outsider' to the group (Loftland and Loftland 1984).

Much has been written on the role of the researcher in the process of observation, such as on the researcher as participant (Spradley 1980, Yang and Fox 1999, Clarke 2009). In practice, while the researcher may attempt to maintain a distance from what she is observing, human interaction may be difficult to avoid. Therefore, it was appropriate that this project used participant observation without separation from the context of what was being studied.

3.4.4 Entering, undertaking, and exiting field work

Nurse Educators facilitated entry to the research setting. The Educators were well known by research participants on each ward as intermediaries who opened doors otherwise locked to outsiders (Fetterman 2010). Through the use of grand tour questions (Spradley 1979), the Nurse Educators provided the researcher with insight into ward routines and the cultural terrain not otherwise accessible '*Could you show me around the ward and tell me a little about the staffing*', for example.

Following an introduction to the site, the researcher spent time speaking with nurses during shift hand-overs or on entry to the site to explain the study and to invite participation for that day. The process for declining to participate was also discussed. Reminder signs with researcher contact details were placed on each ward, indicating that research would be taking place that day. Consent forms and information sheets were also displayed on notice boards for familiarisation purposes.

During field work, the researcher entered the ward and participated (or not, as the case may be) in the daily routines, developing ongoing relationships with the people in it while also observing what was happening. People and their behaviours were noted while attempting to comprehend and interpret the social interactions and their cultural meanings (Rice and Ezzy 2001). Unstructured questioning during observation was performed in an attempt to understand these cultural practices.

Being close to the nurses proved to be the most opportune place for the researcher to gather data on nurses' interactions with vital signs. This resulted in the researcher standing close to the vital sign machines, and then,

while maintaining a discrete distance, opportunistically shadowing the nurse as they approached a patient to take vital signs. Wind (2008) argues for the appropriateness of negotiated interactive observation for health care settings due to the impossibility of participating in a more fully immersive way. Maintaining a degree of remoteness from the activities of the nurse under observation was important, as it is in the space created by distance that the analytical and intellectual interpretations of what is going on occur (Hammersley and Atkinson 1983, Wind 2008).

Access to the field was maintained during each episode by careful explanation of the project to nurses on the shift, and also by engaging in casual conversation about the project – which occurred opportunistically, as well as during refreshment breaks. Questions arising from the researcher's presence were addressed as they came up. Other opportunities to engage with nurses were captured in field notes; during ward rounds and clinical hand-over of care, for example. It was during these moments that the researcher's role was most distinct from that of the nurses. This moving between the role of participant and observer emphasised the researcher's agency over their fieldwork (Wind 2008).

The period of observation varied over the course of each encounter, with a total of 50 hours of data captured in field notes for later analysis. Data collection allowed for periods in which the researcher could leave the ward to make sense of what had been observed and recorded, prior to returning to the field to gather more focused data. Nurses on each shift were thanked for their participation, and the researcher's appreciation was also expressed by providing them with light refreshments during the last observation episode.

The researcher withdrew from the field when no further new information arose during the observations. The decision to leave the field was made when, over time, certain patterns of behaviour repeated themselves, meaning that each new instance of vital sign measurement was consistent with the existing data. Repeating patterns of behaviour have been described in terms of 'theoretical saturation', meaning that generic features of new findings consistently replicate earlier ones (Angrosino 2007). Exiting field work has been described as a 'new beginning to theorising rather than bringing it to closure' (Michailova, Piekkari et al. 2014). Exiting the field at this point, when nothing new was seen to be occurring, enabled data analysis to commence, including higher level theorising.

3.4.5 Field notes

The field work ends when the researcher leaves the research site, but the data analysis continues through examining and rethinking the field notes. Field notes are records of the ebb and flow of events (Hansen 2006) which begin as memory triggers and develop through stages into focussed analytical notes (Wolfinger 2002). To facilitate this process, brief notes were recorded as '*aide-mémoires*' in a notebook kept with the researcher during site visits to jog her memory and to inform her more detailed writing up of the observation (which was undertaken immediately after leaving the ward). The field notes were later rewritten as detailed and expanded analytical notes. Field notes were assigned a number, dated, including time of day, and the research location was recorded. Participants were assigned a pseudonym.

Field notes were written up as expanded notes with analytical memos after each observation episode (see Table 5, below) in an effort to capture not only what was seen and heard, but also to record sensory information, such as sound and the mood of conversations.

Field notes are not without their problems. For example, when undertaking fieldwork, the researcher must decide what to focus attention on among what are often myriad competing events, what is documented, and in what level of detail, even what is recalled. In the beginning, this researcher's field notes were broad in nature, capturing a wide range of observation data – the lighting in the ward, the footwear of the nurses as they moved with pace up and down the busy corridors, forgotten Christmas decorations hanging forlornly over the main desk. Eventually, as the researcher's field work skills were honed, the notes became more focused, concentrating on the main aim of the study: nurses engaged in the act of taking vital signs.

Table 5 Excerpt from field notes

Date	**Research site** 2	**Number**	**Duration** (90 mins)
09/02/2011		13	
Time	**Observation**	**Notes to self**	
0745	Four nurses are seated at the main ward desk, papers loosely arranged in front, pens in hand as they listen attentively to the one speaking. The speaker looks tired; her posture slumped as she sits on the low stool. She reads from her notes gazing at the three others as they write. One nurse looks at the speaker glancing down at her notes from time to time, the other nurses concentrate on their paper. In rooms 14 two nurses stand at the side of the bed of a male patient. He lies back on the pillows, oxygen hissing into two prongs which firmly plug his nostrils, his left arm tethered to the cuff of a blood pressure machine. An oxygen saturation probe clipped onto his finger, the cord snaking across his torso leading to a machine placed on his bedside locker. The machine is loudly beeping in time with his heartbeat. His eyes gaze from nurse to nurse. Overhead the two nurses chatter between each other and occasionally include the patient.	What was the nurse thinking at this time? What value do the nurses ascribe to vital signs in the acute phase of illness? What role does 'chatter' play? What are the nurses thinking during this time?	

This section has described the process of observing nurses' actions and behaviours during the taking and use of vital signs. Observation during phase one necessitated a period of time in the field and collation of analytical field notes. Permission to enter the field was obtained from key gatekeepers, and withdrawal from the field (when no new information was observed) occurred in a way that was respectful to participants. The data analysed from the field notes did not fully explain how nurses used vital signs, which resulted in further questions. More detailed engagement with nurses was required.

3.5 Interview phase

To explain the observed social practices and the structures that may have activated these behaviours, it was important to seek reasons for nurses' action or inaction. A critical realist perspective allows for the subjectivity of these reflexive stories (Archer 2003), as the nurses' voices are equally important for gaining access to their socio-cultural knowledge and rich experiences. This subjectivity was achieved by inviting key informants to reflect upon and share their experiences of vital sign practices. The interview, embedded within semi-ethnographic methods, is an important data gathering technique. Interviews explain and put into a larger context what the researcher sees, hears and experiences (Fetterman 2010).

3.5.1 Interview protocol and strategies

In-depth interviews, by being attentive to the causal explanations, accounted for what the key informants experienced and believed, and this promoted understanding of how they interpreted and ordered their world. The researcher actively probed the interviewees about connections and relationships between particular events, phenomena and beliefs. The interviews in this study comprised conversational questioning, audio recordings, typed transcripts of the recordings, and interviewer notes. To ensure that their consent was informed, participants were advised of the voluntary nature of the study and of the process by which the interview would be conducted prior to commencing (Appendix 5).

3.5.2 Data collection

Whilst opportunistic questioning occurred during the observation period, specific questions were designed for the interviews with key informants (Appendix 7). The researcher derived questions from the data analysed from

the observations made in phase one. The research team then confirmed the questions on the basis of which gaps in the data their answers would fill. 'What' and 'how' questions were developed (and piloted prior to use) in order to understand and explain nurses' behaviours and actions, including their consequences (intended or not) (Appendix 6). Critical realist theory informed the questions, ensuring that they would identify and increase understanding of mechanisms that may exist and, if they did exist, what they caused to occur (Mingers and Standing 2017). Following question development, a pilot interview was conducted with a volunteer to familiarise the researcher with the data recording equipment and the process for data generation.

3.5.2.1 Interview schedule

Having received consent, the interviews were conducted in a quiet environment away from the workplace. The researcher minimised interviewees' apprehension and built rapport by engaging in general conversation before the interview began. The researcher then provided a brief overview of the study's observation phase as an introduction to the interview. Whiting's (2008) questioning approach was used to guide the interviews. The opening question was *'To help me understand a little about you and your interaction with vital signs; can you tell me about the last time you were concerned about a patient's vital signs?*' (Whiting 2008). This first question is the one about which participants experience the most apprehension during an interview, and, by drawing on the participants' experiences, was designed to put the participant at ease.

The exploration phase engaged the participant in more in-depth descriptions. The question '*Can you provide an example where vital signs have made a difference to patient care?*' generated discussion about nurse experience,

patient care, and any collaborative practices. The question '*During my observation on the ward I rarely saw respirations taken. Why do you think that this is the case?*' provided connections between phase one (observation) and phase two (interview), and an opportunity for nurses to articulate their understanding of cultural behaviours, and of the context around vital signs.

The interview then moved into the co-operation phase, which set the scene for free discussion. This is where more sensitive questions were asked (Whiting 2008). This final part is where the greatest rapport develops, and in which the interviewee is seen to be guiding and teaching the interviewer (Whiting 2008). The rapport building of this last phase was most evident in the more experienced nurses, with whom free-flowing conversation occurred.

The interview approach enabled the main topic to be outlined, but the sequence of questions differed somewhat from one participant to the next, essentially in response to the conversations' flow and cues. The use of an interview guide ensured that similar data were collected from each participant, in spite of these variations. Qualitative approaches such as interviews provide experiential understanding (Cioffi 2000), and the nurses in this study were no exception. The purpose of the interview was explained to each informant, including the format, approximate length, an assurance of confidentiality, and the purpose of the digital recorder, and each was provided with time before and after the interview to ask questions of the researcher (Whiting 2007). The interviews varied in length from 40–60 minutes. The participants were assured that they could decline to respond to questions as they wished, and interviews were discontinued when the informant so requested, or chose to stop responding to questions. As the participants spoke, their words were recorded for later transcription and analysis. The interviews flowed in a generally uninterrupted manner, with the

researcher encouraging spontaneous, rich, specific and relevant descriptions (Kirkevold and Bergland 2007), and, using a variety of probe techniques, following up points to clarify meaning when relevant (see Table 6, below). The digital audio recordings were subsequently transcribed by a third party, and the transcripts were checked against the recordings to ensure their accuracy.

Table 6 Probe techniques (adapted from Whiting 2007)

Probe technique	Description
Silence	Interviewer remains silent and allows participant to think aloud
Echo	Interviewer repeats participant's point, encouraging further development of the thought
Verbal agreement	Interviewer expresses interest in participant's views with the use of phrases such as 'uh-huh', or 'yes'
'Tell me more'	Interviewer invites participant to expand on a particular point or issue without the use of echoing

A researcher may be considered, due to their 'insider' perspective, to be a dialogue partner who contributes toward the text developed during the interview, but a neutral position was maintained as much as possible. Interviewing is an unavoidably interpretively active, meaning-making practice, and when qualitative researchers speak and write about culture, we may unconsciously 'write subjectivities into being' (Brinkmann 2007). The research journal proved invaluable in working through issues. Keeping a journal promoted the development of ideas throughout the research process, and in beginning to write about the analysis and interpret the data (Rice and Ezzy 2001).

3.6 Ethical considerations

Formal Human Medical Research ethics approval was obtained for the observation (field work) and interview phases (ref. H0011031), and

institutional structures were adhered to, including seeking written permission from the hospital to conduct the study in the clinical setting. With respect to ethical conduct in research, a research journal was used to record any issues for later deliberation, the research team had meetings, and all data were kept in a secure location, accessible only to members of the research team. All interview participants received a research information sheet, and consented to the observation and interview (Ezzy 2002, Angrosino 2007). During the observation period, it was an identified risk that nurse participants may be observed to omit areas of usual care that could pose risk to individual patients. As an experience critical care nurse, the researcher was required to intervene according to the Australian Health Practitioners Regulatory Authorities rules so as to prevent potential harm occurring. This occurred only once, during the pilot, and is discussed on page 112.

Anonymity and confidentiality were ensured, and participants were explicitly informed before and during the study, and after its completion. Reports of research outcomes or of issues arising never revealed the identities of informants in any way. This was achieved through the use of de-identification and pseudonyms, randomised participant gender swapping, and changing of the names of the wards and hospital. Only the research team had access to field notes, interview transcripts and demographic data, all of which were securely stored on a password-protected computer and in a locked filing cabinet in a locked room of the university for the requisite period following completion of the study. At the conclusion of this period, the data and other material will be destroyed.

To address equity issues in each aspect of the study, informants were selected based on their willingness to be involved. In each phase of the study, the researcher was potentially known to some nurses as 'the lecturer who works at the university', an institution which is closely aligned to the hospital

where the research took place. For this reason, nurses who identified themselves as undertaking studies at the university in programs with which the researcher was associated were not directly included in the study. Beyond those enrolled in postgraduate studies, no one was excluded from the study on the basis of ethnicity, age, gender, or workplace role (such as novice or expert), adhering to principles of justice to ensure equity in representation in the research sample (Rischbieth and Blythe 2005).

Throughout the study, the researcher took to heart the notion that the research 'aims to both hear the voice of the other and to respect the rights of the other' (Ezzy 2002). With this in mind prior to entering the field to gather research data during the observation phase, a number of ethical questions were considered. As the research process required close and ongoing interaction with clinical staff, informed consent was gained from the nurses who agreed to participate in the study. Informed consent enabled the research participants to voice any concerns, and to make choices as to what their participation would involve. Patients' verbal consent was also obtained prior to the researcher entering the room for each observation episode.

To acknowledge the intrusive effects of the research, participation was always at the participants' discretion, with the nurses being afforded the opportunity to opt out of observation on any given day. During interview, participants were advised that they could omit to respond to a question as they wished. Informed voluntary written consent was obtained for all interviews and observations (Appendix 4). The nurses on each ward were provided with an information sheet for their personal reference, and with a consent form explaining the study and their ability to withdraw without penalty at any time (Appendix 4). Informed consent, however, cannot be presumed on each separate encounter with participants in the clinical setting,

and therefore had to be carefully negotiated and reconfirmed in the course of field work.

Interviews with key informants were conducted away from the work setting in a quiet room so that informants' confidentiality was maintained and their privacy respected. Each informant was assigned a pseudonym to protect their identity. Key informants were identified during the observation phase as those who were knowledgeable about the topic, able to reflect and provide detailed experiential information about the use of vital signs, and were willing to participate. Information sheets and consent forms were distributed via email when confirming the interview appointment time. Permission to record interviews was obtained prior to commencing.

3.6.1 The research journal as an ethical tool

The research journal proved invaluable as ethical problems arose. Also, with respect to maintaining research integrity, the journal provided a means of capturing ethical dilemmas which could then be worked through with supervisory support. For example, as both researcher and nurse, the researcher had to work through instances where interventions might be made to address perceived problems in patient condition or care delivery. The journal was particularly useful during the pilot observation, as this episode illustrates:

> Medical Consultant '… *set up CPAP and call me if his* [oxygen] *sats drop further … he's not for ICU* [intensive care admission]…' I watch quietly from a distance as the Nurse Manager and accompanying nurse hurry to gather the equipment. I glimpse an elderly male patient lying slumped in the bed his rapid respirations uncomfortable to watch. … random pieces of equipment are hastily plucked from shelves and assembled ready to be pushed to the bedside… I can see that what is being selected is incorrect. I feel terrible … ethically torn as a researcher to not interfere with natural behaviours, but with the patient's safety in mind, I intervene and tell the

two nurses that they had the wrong device and that they should call for a physiotherapist to bring the correct machine to the patient.

Journal extract: Pilot observation episode

The research journal enabled any tensions that the researcher experienced in separating the roles of nurse and researcher to be documented and critically examined, thus promoting a valid account of meanings and beliefs held by research participants, and also building research integrity. Any tension felt by the researcher was not transmitted to research participants. The journal also provided a space for research reflexivity regarding preconceived assumptions and beliefs (Ortlipp 2008).

3.7 Data analysis

The data were collected and analysed in a recursive manner. This enabled a 'rich evocation' (Jocelon and O'Dell 2005) for understanding cultural behaviours around the taking, recording and use of vital signs in natural and often complex situations. Within a critical realist framework, culture is important to understand, as it is where the sharing of ideas is contingent, and where there is interplay between ideas and modifiable socio-cultural interactions (Archer 1998).

Qualitative data analysis is a process of noticing, collecting and thinking about things in an iterative and progressive cycle which is constantly being revisited with a view to noticing new things (Seidal 1998). Data analysis in the observation phase began as soon as the researcher entered the field to see and understand phenomena. Analysis continued throughout the researcher's involvement in field work. In the interview component and during observation, verbatim quotations were gathered to present a credible report of the research, and to allow readers to judge the quality of the work. Field

notes and interview data were transcribed for coding; the researcher listened to the audio recordings while reading and re-reading the transcripts in order to identify emerging themes using the six-phase model by Braun and Clarke (2006). Data saturation (Mason 2010) was deemed to have occurred when nothing new was found to add to the explanatory theories that emerged from the thematic coding generated from the field observations and key informant interviews.

The use of thematic analysis generated codes and themes for subsequent analysis within a critical realist methodology. The process involved 'analysing transcripts [of field notes and interviews], identifying themes within the data and gathering together examples of those themes from the text' (Burnard, Gill et al. 2008, p.429) using themes emerging from the data (Essy 2002). The phases of thematic analysis (see Table 7) reflected phases one to four of Braun and Clarke's (2006) six-phase model. Phase one is familiarisation with the data, phase two generating initial codes, phase three searching for themes, and phase four reviewing themes. For the purpose of the study, the coding process occurred in both of the qualitative phases, by looking for patterns, relationships and emerging themes, which resulted in spending time reading and re-reading what had been captured to help with the stages of coding. Following thematic analysis, the critical realist process of abduction and retroduction was used to identify causal relationships (Danermark et al. 2002). The following table, Table 7, shows the stages of thematic analysis (Braun and Clarke 2006), with examples of data coding, and of data abduction and retroduction (Danermark et al. 2002). Further details of a critical realist explanatory theory are provided in Section 3.8, below.

Table 7 Phases of thematic analysis (adapted from Braun and Clarke 2006) and CR Theoretical stages (Adapted from Danermark et al. 2002)

Thematic analysis phase	**Description of the process used in this study**	**Examples of coding from observation and interview data**	**Critical realist phase** (Detailed in Table 8)
1 Familiarise yourself with the data	Transcribe data, read and re-read the data noting initial ideas.	Analytical field notes Interview data transcript	Stage one: Description
2 Generate initial codes	Code interesting features of the data in a systematic fashion across the entire data set; collate data relevant to each code.	Deciding when to take the vital signs, prioritising, deciding who will take the vital signs, how vital signs are taken, acting on information from vital signs, relying on technology, delegating vital sign taking and recordings	Stage one: Description
3 Search for themes	Collate codes into potential themes; gather all data relevant to each potential theme.	Time to do the 'obs'; vital signs as routine; vital signs as negotiated and delegated work	Stage two: Analytical resolution
4 Review themes	Check if the themes work in relation to coded extracts (Level 1) and the entire data set (Level 2), generating a thematic map of the analysis.	'They're ok/They're not ok', 'Knowing how: vital signs a task to be done', 'Knowing why and when'	Stage three: Abduction
5 Define and name themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generate clear definitions and names for each theme.	Nurses' vital sign practices: Context, culture and structural factors Experience, ward culture and vital signs Vital signs, physiological deterioration and clinical judgement	Stage three: Abduction
6 Produce report	The final opportunity for analysis. Select vivid, compelling extract, final analysis of the selected extracts; relate back to analysis and the research questions and literature. Produce a scholarly report of the analysis.	'*Unfortunately I think to some degree it's become a bit of a task oriented type of activity*' (Hattie RN Y14). *'Very much an attitude of that you're taking away our nursing ability …which I find is very interesting because …we kind of didn't have the ability beforehand*' (Lucy RN Y20). *'Look, this persons in MET criteria,' 'Yeah, we know,' 'Well what are you going to do about it?'* (Nic RN Y15).	Stage four: Retroduction

3.7.1 Analysing the observation data

Field notes were word processed immediately following observations. Initially these notes were rewritten as thick descriptions of the episodes observed on the ward, but after several sessions, the notes were written up in this way immediately following field work. The writing stage took several hours to capture what had been observed from a 'multi-sense' perspective. The observation was mulled over for several days, with resultant later insights captured in the research journal or as a memo. To assist analysis, the right hand side of the page had a wide margin for recording ideas and emerging themes as the detailed field notes were written. This formed the initial coding stage. After each site visit, and as the field notes were written, questions were formed and captured in the document, which would then inform the next on-site observation.

Following completion of 50 hours of field work at the two research sites and the transcription of the observations into comprehensive field notes, the data were entered into NVivo (version 10) for further analytical coding. It should be noted that coding occurred in both the hard copy data files and in NVivo10, promoting a deep engagement with the words, spaces and contextual actions of the research participants. The field notes captured the environment in which the participants practised, as well as others who entered that environment, albeit transiently. Sounds, ambience and light levels were noted in order to paint a picture of the spaces in which activities occurred. A rough map of the ward areas was hand- (and later computer-) drawn to signify and connect the observation site to the study.

Initially open coding was used, which captured a word or phrase to summarise a section of the data (Essy 2002, Saldana 2009). As the notes were read, phrases or key words were highlighted by pen, and also in NVivo, then

grouped into analogous areas, forming a code. Fifty-four codes were identified from the field notes, and these were further analysed for similarities or other relationships. To support an iterative process, the codes, themes and sub-themes were re-analysed according to phase four (see Table 7, above) (Braun and Clarke 2006) to further explore the relationships and to identify them across the entire data set (phase five). The researcher incorporated theoretical memos to add to the iterative process. These were recorded in NVivo10, as well as in an 'at hand' research journal, which also contained notes of decisions, thoughts, and conversations with others, adding to the process of transforming and interpreting the qualitative data in a rigorous and scholarly way (Hansen 2006), and further strengthening the emerging themes.

3.7.2 Analysing the interview data

Following transcription by a third party, the text of the 20 interviews was read and re-read to identify emerging themes and patterns. Also, the audio recordings were repeatedly listened to and checked against the transcripts. Annotations were made on individual transcriptions while reading the data and listening to the recordings as the first stage of qualitative coding. Using the steps described in the observation phase, which incorporated data reduction thematic coding in NVivo10, coding revealed themes and sub-themes in keeping with the thematic analysis principles described by Braun and Clarke (2006). After coding, each phase was analysed to identify generative causal mechanisms at the research sites.

3.8 Stages of critical realist explanatory research

In answering the research questions, a process of abduction and retroduction was used to analyse themes that emerged from the observations and interviews. This process gave rise to explanations of the mechanisms (potential causal factors) and structures that operated under particular conditions. The central tenet for researchers using an explanatory model of critical realism that aims to attain knowledge of constitutive qualities and causal mechanisms (Danermark, Ekstrom et al. 2002) is one of abduction and retroduction (see Table 8, below).

Abduction is a process which, using the themes from the data, interprets and redescribes the structures and relationships between them using a theoretical model (in this case, critical realism). Retroduction uses the same approach, but focuses on answering the questions '*What is fundamentally constitutive for the structures and relations of X (the features highlighted during abduction)?*' and '*How is X possible?*' (Danermark, Ekstrom et al. 2002). More importantly, the critical realist explanatory process facilitated understanding of the continuous processes by which 'X' produced 'Y', as well as the contextual processes that connected these events (de Souza 2014), rather than simply knowing that 'X' has generally been followed by 'Y'. Thus the principle throughout retroduction is to identify and describe the generative mechanisms that can explain the phenomenon in question (Blom and Moren 2011).

Critical realism therefore builds upon an articulated ontology, which provides a view of how reality is constituted for agents (Blom and Moren 2011), thus providing explanations at a level deeper than the empirical and observable. The following table, Table 8, provides examples of the theoretical stages of data analysis with examples aligned to the study.

Table 8 Stages in an explanatory research study based on critical realism (adapted from Danermark, et al. 2002, p.109–110)

Theoretical stages	Application to the study	Study examples
Stage 1 Description	1. Description of the context, and its complexities, in which the study took place, including the actions and behaviours of the nurses	Observation of vital signs taken on medical and surgical wards
Stage 2 Analytical resolution	2. Identification of the various components for study	Technology and practice, delegation of vital signs, knowledge of patient and illness trajectory
Stage 3 Abduction	3. Interpretation and redescription of the different components which reflect theories about structures and relations	Communication and power differentials Customary practices
Stage 4 Retroduction	4. Using each individual component, ask questions about what structures and relations must exist for X to be possible. What properties must exist for X to be what it is?	When experience and specialisation are present, what is the effect on nurses' agency and why?
Stage 5 Comparison between abstraction	5. Describe the relative explanatory power of the mechanisms and structures identified through abduction and retroduction. Further, describe the necessary conditions for what is to be explained. Which has greater explanatory power?	Cultural influences Power dynamics Reflexive deliberation
Stage 6 Concretisation and contextualisation	6. Re-examine how different structures and mechanisms manifest themselves in concrete situations. This stage explores the manner in which mechanisms interact with each other under specific conditions with the aim of interpreting the meanings of these mechanisms in certain contexts. A secondary aim is to consider how these mechanisms contribute to explanations of concrete events and processes	Experience, as an emergent power, generates nurse agency

Applying these concepts to the study, the themes arising from the observation and interview were compared, and structures and mechanisms identified. These structures and mechanisms were seen to exist in the more or less objective social rules in the research setting. It was not sufficient to identify explanations that occurred in a 'horizontal' fashion, meaning 'event A produces or precedes output B', so instead a vertical explanation for events was sought (de Souza 2014). For example, nurse experience relied not only upon specialisation in an area of nursing practice, but also on longevity in the ward setting, and was seen to manifest as a generative mechanism for patient-centred care. This process of abstraction enabled a deeper understanding of processes related to nurses' use of vital signs (including their historical context) and how they influenced, changed or sustained the measurement of and response to vital signs in given situations.

In summary, thematic analysis was the most appropriate method for initial analysis of the data for this research study, and sits well within a critical realist methodology. Both approaches offered flexibility in relation to methods which 'can be applied across a range of theoretical and epistemological approaches' (Braun and Clarke 2006, p.78). Using methods of abduction and retroduction generated explanations of causal themes and relationships, and of the conditions under which these were active (or not). This enhanced the credibility of the research, as well as the trustworthiness or validity of a critical realist approach.

3.9 Research rigour and trustworthiness

Research rigour and trustworthiness were addressed at each stage. The researchers met monthly to audit the research approach, and a report was presented annually to the University Institutional Medical Research Ethics committee, which had oversight of the project. Each phase of the project required its own internal and external checks in order for the outcomes to be faithfully reported. Qualitative research must address issues such as credibility, trustworthiness, transferability, confirmability and integrity. Guba and Lincoln's (1989) criteria of credibility, transferability and dependability refer to the conventions of internal and external validity, and reliability.

For each phase, the research necessitated reflexivity (an inward-looking process) on the part of the researcher, from constructing the research design, to the context, to data collection, data analysis, the position of the researcher, and the presentation of findings (Finlay 2002). As a critical care nurse with many years of clinical experience addressing patient deterioration, this was achieved by accepting and openly accounting for personal and professional assumptions, beginning from the perspective that nurses did not use vital signs properly. To run with this assumption would have stifled the researcher's thinking, which, if unacknowledged, could have influenced the data gathering processes. Through the use of a reflexive approach and the acknowledgment of the potential effect of personal sentiments on each aspect of the study, the research findings avoided bias. The use of a research journal, memos and researcher meetings assisted in the process of reflexivity, and, in doing so, improved the quality of the study. Journaling also reduced subjectivity or bias, which is an inevitable component of research processes when a researcher brings their emotions, intuitions, values, prejudices, presuppositions and personal agendas to a project. Each of these things 'must be kept reasonably in check by [means of] a number of more of less general methodological rules and considerations' (Maso 2003, p.39).

Using sequential qualitative methods, the researcher captured close up, detailed, varied and contextualised accounts of the experiences, actions and perceptions of nurses' vital sign practices, and this breadth of data improved the research's trustworthiness. 'Validity', as used in research, describes the level of quality and rigour of research, but the term can be confusing (Zachariadis, Scott et al. 2013). Vankatesh et al. (2013) provide three useful categories for research validity applicable to qualitative research, namely design validity, analytical validity, and inferential validity (Vankatesh, Brown et al. 2013). To achieve high validity in a research design for studying a practice-oriented discipline such as nursing, in which human agency must be accounted for, critical realism was appropriate as a methodology. This approach involves data analysis for the purpose of formulating general answers about the nature of the world and about what counts as social-scientific knowledge (Bhaskar and Danermark 2006). The implications of using retroduction (Table 8, p.119) in knowledge creation necessitated discussion about the approach to assure analytical validity and the quality of inferences drawn in the research.

Auditing each step of the research process ensured that the research was logical, ethical, methodologically faithful, traceable and clearly documented (Tobin and Begley 2004). Methodological quality has the following key elements: documentary rigour, procedural rigour, ethical rigour, and auditability (Burns and Grove 2009). Ethical rigour required the researcher to recognise and discuss the ethical implications of the study, and ethical practices were worked through with research supervisors to ensure the project's integrity.

Research trustworthiness and rigour is determined on the basis of the willingness of stakeholders to act upon the results (Dellinger and Leech 2007). Table 9, below, applies elements of trustworthiness and rigour for qualitative

research in constructing and reporting this project within a critical realistic methodology.

Table 9 Research rigour and trustworthiness

Validity type	Description	Literature	Critical realism	Research audit
Design validity (credibility, descriptive validity transferability)	Accuracy of events, objects, behaviours and settings reported. Results are believable. Research design can be applied by others.	Alder and Alder (1994) in Denzin and Lincoln (1994) Rolfe (2004) de Souza (2014)	• Explanations of mechanisms in action and the conditions in which they are interacting. • The suggestion is that similar or related events that may or may not occur in other settings are caused by the generative mechanisms that caused the events in the field. • Generalisability is underplayed as repeatability of events is contingent upon conditions which cannot be controlled, and multiple mechanisms operate, depending on context and history.	• Research problem and questions arose from clinical practice as an experienced critical care nurse. • Data collected and analysed in an iterative process until data saturation. • Codes and themes confirmed with experts. • Others report a sense of verisimilitude in data. • Research meetings with experts. • Conceptual mapping. • Relevance to practice. • Audit process recorded and filed. • Data recorded and reported in context.
Analytical validity (theoretical validity, dependability, consistency, plausibility)	Theoretical explanation fits the data. Rich description of research setting and methods. Plausibility defines data fit. Consistency of research steps.	Rolfe (2004) Danermark et al., (2006) de Souza (2014)	• Theory is used to assist hypothesising about mechanisms and the events that cause them. • Identification of contingent factors. • Challenge and maintain a process of ongoing inquiry. • Reveals valid knowledge of actual mechanisms of generative mechanisms in the field. • Incorporates vertical explanations of mechanisms which exist in different strata thus focusing on processes to understand what it is about the structure of the object of study (vital signs) that causes or enables it to produce or sustain a certain event (nurses action or inaction) whereas horizontal explanations only explain events and their antecedent causes.	• Methods congruent with critical realism and methodology using a process of abduction and retroduction. • Clear reporting of research process. • Research journal. • Ethics reporting.
Inferential validity (interpretive validity, confirmability)	Interpretation of participants' views is accurate and results are confirmed by others.	Alder and Alder (1994) in Denzin and Lincoln (1994) Rolfe (2004), de Souza (2014)	• Findings provide information about the mechanisms that cause events at the empirical level.	• Reflexivity in data reporting and maintaining a research journal. • Data collected systematically and repeatedly over varying conditions. • Faithful reporting of data.

3.9.1 Study limitations

A critical realist approach is not without limitations, in that answers are not generalisable, nor necessarily repeatable. This is because whether a mechanism is triggered is contingent upon particular historical, social and cultural conditions which cannot be controlled, as multiple mechanisms may operate (de Souza 2014). There are multiple valid perspectives on reality, and these compete, meaning that there can never be a truly objective controlled study; variables can never be completely controlled. However, for this two-phase qualitative study, reflexivity, knowledge, research audits, ethical practices, and intellectual curiosity were united in an interactive and iterative process to produce robust, valid outcomes.

Sample size is often a serious limitation for qualitative research, as it is not possible to make generalisations when studying individuals in a changing, context-rich environment (Hansen 2006). To uncover the mechanisms and the related structures or powers which produce vital sign practices, participants were representative of the target population. This accounts for nurses' interpretations and actions by explaining the role that personal powers play, by acknowledging the choices they make, and the perspectives they have on vital sign practice. Acknowledging the role that reflexivity has in personal contexts, and how these experiences operate at socio-cultural levels may, however, prioritise different sets of concerns. Therefore, while quantitative studies are concerned with reliability and validity, qualitative research concentrates on authenticity and trustworthiness (Denzin and Lincoln 2005).

Unpredicted variables were accounted for in the study, as the environment in which vital signs were taken was influenced by a period of organisational change; policy and procedures for responding to physiological changes in vital

signs were implemented partway through the project. The ADDS was implemented part-way through the study in response to the publication of the Australian Commission on Safety and Quality in Health Care recommendations for vital sign measurement and response systems. This may, in part, have influenced and explained the behaviours and responses of the nurses during the observations and interviews.

3.10 Chapter summary

This chapter has detailed a research design that supports methodological rigour and trustworthiness. The research approach for this project incorporated sequential phases of in-the-field observations and key informant interviews to provide a qualitative explanatory approach to data gathering. Research participants consented to participate in specific phases of the study, and only those who identified themselves as studying at the researcher's university were excluded. Observation and interview data were transcribed for analysis. Memos and journal entries provided fora for the researcher's ethical quandaries.

Data analysis occurred in keeping with key critical realist tenets of a stratified reality in order to identify generative mechanisms and structures which had the potential to enable or constrain agency whilst maintaining ethical, procedural and auditable validity. The framework for data analysis generated codes and themes which were scrutinised using the methodological approach of abduction and retroduction suggested by critical realist researchers. Research auditability is evident at each stage of the research design, enhancing its trustworthiness. The next chapter is the first of two presenting an analysis of the data. The first deals with the data gathered in observation of nurses' vital sign practice, drawing attention to any structural or generative mechanisms at play, then interpreting them.

Chapter 4 Where, how and when: Observing nurses vital sign practices

Ten to ten… I suppose I should do some obs… (RN, Site 2, Obs 17).

Nurses vital sign practices are an important element in the detection and response to patient deterioration. The research design included observation in order to understand practices and the context where they occur. Additionally, identifying and understanding the interactions and power relationship between nurses and the people with who they worked, were able to be observed. This chapter describes the results analysed from the observation phase through a critical realist lens.

Contextual and organisational factors which influenced nursing practice are reported in order to understand the interplay between nurse's agency and social structures observed in the measurement and response to vital signs. Ward structure is described, including how nurses worked with others, as well as aspects of organisational governance, including MET and ADDS systems, and how this all interrelated to generate the context for vital sign practices.

The concepts which emerged from the qualitatively analysed field notes are described using examples from the research sites. Field notes excerpts are identified by a code for the observation site and the record number in brackets. Participant's quotes are identified by participants' years of experience, and profession in brackets. Four key areas were identified: '*They're ok/They're not ok*', which represents the notion of trust and distrust

of vital signs, and also of knowing the patient, and; '*Knowing how*', which was linked to nurses' procedural knowledge of vital sign measurement. *'Knowing why and when*' vital signs are procured includes understanding the consequences of agency (or lack of it). Cultural aspects are addressed in '*Knowing the culture*', which is the final theme of phase one.

4.1 The setting for vital sign practice

The nurses referred to vital signs, the measurable cues of physiological status in the world of nursing practice, as 'the obs' (observations). The 'obs' seen to be taken by nurses included blood pressure, heart rate, temperature, and pulse oximetry by non-invasive means. It was difficult to observe nurses counting respirations. The process took very little time (about 30 to 45 seconds), and there were few visible indications that it was taking place. In step by step fashion, nurses would:

> select an electronic device then take it to the bedside, look at a clock or watch, pick up and wrap the blood pressure cuff around the arm, place a pulse oximetry probe on the patients finger, press the button on the machine, turn, root through a basket containing a tangle of cords on the machine to pick up an electronic tympanic thermometer, take the temperature and when the machine had finished processing, write the vital signs down in the bedside chart. In the main throughout the procedure, casual 'chatty' type conversation would occur between the patient and the nurse (Field notes, Sites 1 and 2).

4.1.1 Design barriers: Ward layout and work design

Both wards were constructed around central hubs referred to by the nurses as 'the main desk'. At this desk, patient records and a selection of portable electronic and manual vital sign monitoring instruments were stored. A small number of patient rooms had wall-mounted manual blood pressure devices close to the bed, but none of the nurses ever used these during the

researcher's observations. The layout of the wards affected upon vital sign measurement, because nurses often needed to make multiple journeys, sometimes quite a distance from the current patient, to get the equipment they needed. Difficulty locating equipment was a daily occurrence, and hindered the ability of the nurses to complete tasks quickly, which appeared to be a priority in the busy ward setting. A consequence of this difficulty was that at times a vital sign would be omitted, predominantly oxygen saturations or temperature. This was observed to occur particularly if the patient was placed in an isolation room and when the monitoring equipment in that room did not include a full set of data collection tools. As an example, during a patient examination in an isolation room with no pulse oximeter visibly available, the medical consultant asked the accompanying doctor:

> … "*are the obs there?" … "Temperature 36^{o}, BP 156/90" … "sat's* [oxygen] *not done"*… is the response from the attending medical officer (Field notes, Site 2, Obs 17).

Such omissions of individual vital signs raise doubt as to the value that nurses place on the completeness of a full set of vital signs, and as to the significance placed on them in the overall care of a patient.

In addition, nurses' time would be spent locating not only equipment, but also other resources required to support and communicate patient care. For example:

> A doctor comes out of room 13 after leaving the bedside of a patient. She asks the passing nurse where the drug chart is "I just want to see if we charted it [antibiotic dosage] correctly". What then ensues is ten minutes of 'hide- and-seek' to find the missing chart. The nurse enters the patient's room on several occasions relooking at the same nothingness at the foot of the bed. The holder where the chart should be remaining empty. She asks passing nurses have they seen the chart, the hospital aide joins in the search. The corridor is walked up and down; rooms peered into and re-peered into. The nurse in charge joins the search, questions are re-asked of passing nurses. The doctor meanwhile waits patiently for the chart. After much to-ing and froing the doctor says "Oh well we will just have to

> say it was ok", she moves up the corridor toward her waiting medical ward round colleagues. The nurses continue their search for the chart. The nurse who commenced the search disappears around the bend in the corridor heading for the adjacent ward. She reappears a few minutes later, a triumphant smile on her face as she displays the missing chart in her hands. She moves quickly up the corridor toward the doctor who requested the chart. Heads close together as they peer at the page in the folder. The other nurses go back to their work (Field note, Site 2, Obs 19).

In this instance, nurses time away from direct patient care could have been averted had a doctor from another medical team, not taken the notes to a different ward for a purpose unknown.

In terms of work design, each ward employed a team-based model of nursing care delivery in which two nurses worked with up to ten patients in a specific section of the ward. Team nursing did not appear popular, with one nurse commenting that team nursing has '*affected the way we assess our patients … meaning everything has come down to tasks*' (RN, Site 1, Obs 1). It appeared that there were two approaches nurses used for team nursing. They would either work together, sharing vital sign measurements, one undertaking the task, the other documenting the results (Field notes site 1 and 2), or they would work in isolation from one another, neither knowing what was happening with their team mate's case load. As one nurse recounted:

> *… if someone asked me about … say the patient in room 8 …. I wouldn't have a clue….I concentrate on mine* [patients] *…. I couldn't look at anyone else's … I don't have the memory … I have enough to do with mine* … (RN, Site 2, Obs 23).

Students of nursing were on practice rotation at both research sites during the period of observation, and depending upon the allocated task and level of education, were supervised by a registered nurse. At both research sites, the

students and nurses were observed to work congenially together, at times sharing the taking of vital signs:

> …The male nurse reappears into the corridor taking the blood pressure machine with him. Glancing up the corridor he walks toward room 14. A female nurse standing near the desk asks as he nears, "Whose left to do"? The male nurse responds with an incline of his head toward room 14 "two in there". She names a doctor who is in the room seeing patients. He responds "Nah don't want to go in there". [The doctor is reported as unpopular with the nurses]. They both smile. She goes to wash her hands, "Go for a drink" she says "Yeah" he responds. "I can do them" she replies as a he walks toward the desk, pausing to strike off the time vital signs were measured on a shift planner stuck to the wall (Field notes, Site 2, Obs 16).

Another example of working together was observed when a student was allocated the taking of vital signs for a postoperative patient at site 1. The accompanying nurse sat at the bedside, writing the student's readings into the patient's chart. Nurses allocated to the ward from other areas or from the casual pool to fill gaps in the ward roster and final year students of nursing were both seen to measure vital signs independently.

Consultation occurred between students and nurses when there were problems. For example, when discovering that a patient had low blood pressure (96 over 65 mmHg), the student said to the researcher '*I will go and tell Amanda* [an RN] *about this*' (SN, Site 1, Obs 3). The RN responded to the student by ceasing what she had been doing and accompanying the student to the bedside to recheck the blood pressure, which was confirmed to be lower than expected. The nurse was later seen paging the doctor for a patient review. The significance of this episode is that the patient's mean arterial pressure (an indicator of vital organ perfusion) displayed on the blood pressure machine was 75 mmHg, which is within normal limits. The nurse was not provided with the mean arterial pressure reading by the student, nor did the nurse report this parameter to the medical officer when confirming the

abnormal vital sign, suggesting the limited value they place of this result for patient care.

Delegation of vital signs was a common occurrence at both research sites, usually to someone who was not a regular member of the ward staff (and was therefore least likely to know the patients). Students of nursing and casual or relieving nurses were most likely to be assigned the vital sign tasks for patients of whom they often had no previous knowledge, with one casual relieving nurse recounting, as he wheeled a blood pressure machine into a patient's room, '…*this is difficult as I don't know any of the patients*' (EN, Site 1, Obs 1). Whilst a relieving nurse may be comfortable with the ward layout and, to some degree, with ward routines, they lack the knowledge of the patterns of illness patients may exhibit during their recovery from illness. Also, the relieving nurse may be faced with situations not encountered before, and are also the ones most likely to be delegated to measure vital signs of patients they do not know.

The following field note reveals the importance of knowing the patient and their illness. As the nurse:

> took the blood pressure – the cuff made noises like it was going to come off. The saturations were 85, she changed the probe to the other finger and the reading was 85 saying [to the researcher] "I am just going to look at her notes to see what they usually are" (Field note, Site 1, Obs 5).

Recognition of changes in a patient's condition requires not only skills in assessment, clinical judgement and decision-making (Minick and Harvey 2003), but also an ability to know the patient's usual illness parameters, as well as their current condition and past medical history.

When informally discussing patient cases in the staff room or talking to the researcher or each other, nurses periodically mentioned the MET. The MET response criteria were issued to all nurses and medical staff, at the time of employment, in the form of cue cards, and were seen attached to staff identification badges. At no time did the researcher see these cue cards being checked by a nurse or medical practitioner in response to an abnormal vital sign. Nurses appeared to place little reliance on a single abnormal vital sign, such as a low blood pressure, and no MET response was activated during the research observations. When an abnormal vital sign was detected, the nurse would either document it and continue taking vital signs of other patients, or would declare the abnormal parameter to another nurse, usually the shift coordinator, and then continue with other duties. The researcher repeatedly saw discretionary judgments being made about the response to vital signs that did not follow the MET criteria, and these judgements could not be fully explained through observation alone. No patient harm was observed that necessitated researcher intervention.

MET governance procedures affected nurses in other ways, too. They were required to attend deteriorating patient education as a result of the recent organisation-wide implementation of the ADDS, which occurred during this phase of the study. One such attendance resulted in a casually employed nurse commenting during the taking of vital signs that *'resps* [respirations] *are important … I remember they said that on the study day'* (RN, Site 2, Obs 24). Despite organisational governance structures such as the MET and, more recently, the ADDS being in place at the time of observation, a gap existed between what was expected by the organisation and the nurses' actions. This gap is detailed further below.

4.1.2 Vital signs in the context of busy wards

On a daily basis, the nurses encountered numerous challenging situations which required some degree of clinical decision-making and interaction with others. Dealing with complexity so frequently is a reality which influences an individual's ability to decide the course of action in response to the demands of changing situations. Patient admissions and discharges were observed to add to ward busyness by interrupting the dynamics of nurses' care of patients. These interruptions could range from the need to seek additional staff to fill roster gaps, to assisting doctors with procedures, or to answering phone calls. The field notes reflect the various complexities addressed by nurses during a very small window of observation:

> The Nurse Unit Manager (NUM) and Assistant Director of Nursing (ADON) are at the desk talking. The NUM says "*Why can't admin check the roster? The time it takes me to do it, I'm not clinical*. *Why do I have to do it and not admin?*" In the same breath, "*Why am I ordering bread, butter, vegemite?*", "*I sign it then* [name – ward clerk] *takes it down to the kitchen*". "*What else? Oh my god all admin stuff*". The ADON is nodding, responding in agreeance.
>
> A doctor walks down the corridor from a patient's room asking a nurse, "*Did you do that blood culture?*"; The nurse stops what he is doing (recording in the patient's notes) and returns carrying a collection of blood culture bottles and venepuncture equipment. He goes to the doctor seated at the desk. The doctor says "*Do you mind if you could get me sterile gloves?*", "*What size?*", "*7 ½*". The nurse wanders down the corridor back toward the store room, returns with the gloves and places the package with all the other things he left on the desk in front of the doctor.
>
> A medical ward round is in progress. At the bedside of the patient, a doctor leans across to a female doctor holding the patient's notes asking "*What's his BP doing?*", the other doctor holding the folder flicks quickly to the chart with the vital signs "*A bit low but not too bad*".
>
> All the while the phone has been loudly ringing over the observation period, only answered by nurses (Field note, Site 2, Obs 8).

Ward busyness was compounded by the limited number of beds, and this was even more evident in the acute medical ward. The high turnover meant that

patients were regularly admitted (on one occasion, eight new admissions overnight), requiring nurses to quickly prepare patients for discharge or transfer to other areas of the hospital:

> As I enter the ward there is an overwhelming sense of busyness permeating the air. Nurses rush from room to room, some with sheets and wash bowels, others pushing blood pressure machines ahead of them. Doctors gather around the bedside of a patient in room 16 chatting softly to each other. The whiteboard attached to the wall outside room 14 shows 16 patients are on this side of the ward. Written in red pen are eight names indicating that they are the new admissions that require medical review. The ward has an aura of chaos about it which is reflected in the hurrying feet of the nurses and the fast shuffle of the doctor as she walks rapidly down to the desk to pick up notes scurrying back to the group of waiting doctors as the ward round commences (Field note, Site 2, Obs 19).

Making beds available for new patient admissions was a priority for hospital supervisors, and pressure was placed on shift coordinators to move patients out of the ward as soon as possible. This, at times, created tension, and challenges prioritising patient care, particularly during days of staffing shortages and when patients were considered to be acutely unwell on arrival.

It was reported by nurses that patients newly admitted from the emergency department required vital signs to be taken on admission to the ward, and then four-hourly for 24 hours (Field note, Site 2, Obs 8). However, it appeared that it was not unusual for patients to be transferred from the emergency department exhibiting signs of deterioration, which added to ward busyness:

> *….we had a bad shift on Thursday evening ….we had four admissions and three of them were high dependency reviews* [MET calls] *within five minutes of getting here … the Afterhours Nurse Manager wasn't very supportive just told us we had 15 minutes to sort it out before the next one came up … I don't think he likes us …'.* She grimaces saying *'… I better get back to the ward …* (RN, Site 2, Obs 25).

Awareness that patients could be transferred with acute problems requiring attention resulted in nurses prioritising vital sign measurement on first arrival to the ward. This prioritisation was considered important by research

participants. For example, a nurse pondered aloud on the arrival of a new patient: '…*what's first … drugs or obs? Obs. Definitely obs*.' (RN, Site 2, Obs 24). On another occasion, a nurse waiting for a patient to arrive from the emergency department remarked '…*they have been held in ED because of a hypo* [hypoglycaemia] … [Laughing] … *they usually leave it for us to find* ….' (RN, Site 2, Obs 14).

As the episodes above suggest, it appears to be tacitly accepted that abnormal vital signs are likely to be present on patient transfer, and the actions of the nurses reflect this. The nurses appeared to prioritise taking vital signs of new patients over other care tasks. However, accepting abnormal vital signs as being a normal event on admission is highly problematic if these signs are not recognised as indicating deterioration. The literature suggests that there is a strong association between changes in vital sign physiology during emergency department care (through to admission) and in-hospital death (Considine, Jones et al. 2015). Patients newly admitted from the emergency department would therefore require careful vital sign monitoring, including interpretation, to avert adverse events such as deterioration.

The significance of vital signs at the other end of the patient journey is highlighted when assessing readiness for discharge, with no nurse during the observation period visibly taking a patient's vital signs prior to their leaving. Instead, attention was focused on ascertaining the availability of medication prescriptions, or on referral to in-hospital or community health professionals prior to transfer or discharge. Assessing vital sign instability on discharge from a ward could be a clinically objective means of identifying readiness and safety for discharge from hospital. The lack of pre-discharge vital sign measurement, regardless of the time of discharge, is revealed in a nurse's response to noticing the time:

> *Ten to ten … I suppose I should do some obs … we have some patients going home … no point in doing them [*laughter*] we may find something wrong and they have to stay …* (RN, Site 2, Obs 17).

This idea of 'not looking for a problem' could be a product of a belief that 'all is well', and warrants exploration in the interview data. The nurse's laughter also relays a sense of 'all is well', which is in accordance with the 'whole of person' approach that is further presented in the data.

To summarise, the wards were observed to be busy on most days, with patient admissions and discharges generating additional activity. Nurses' frequently spent time locating missing equipment or other patient resources, which removed them from patient care. Patients were often transferred from the emergency department to the ward with vital sign abnormalities, which resulted in nurses prioritising vital signs for new admissions. During discharge-from-ward episodes, vital signs were given lower priority. Senior nursing staff were seen to be under additional pressures which took them away from direct patient care, but they also appeared to be responsible for ward resourcing.

4.1.3 Trusting others' vital sign practices

Nurses engaged with doctors on a regular basis, and the role of this relationship in vital sign practices was revealed throughout the observation phase. During the morning shifts, a large number of health professionals visited the wards, and, through their actions, interrupted nurses' care. The impact of medical staff presence on the ward was that nurses were seen to defer the taking of vital signs, which would be expected if patient examinations were occurring. However, if a nurse was taking vital signs when the medical staff arrived, they were interrupted. Doctors would gather at the bedside regardless of the nurse's actions and would speak to the patient

during the procedure. In response, nurses removed themselves from the bedside, leaving the vital sign equipment behind, or moved away to take another patient's vital signs. The following field note captures this during a vital sign episode:

> Reaching the side of the bed, she tells the patient she is going to take the blood pressure. Pushing the machine ahead of her, she begins to walk toward the patient as the medical consultant enters the room. Carrying a chair he walks toward a patient and places the chair at the foot of the bed. He turns and approaches the nurse who is beside the patient she was about to take the vital signs, stopping to place his hand lightly on her shoulder he asks "Are you looking after Mrs Smith?", looking up toward him she responds "yes", he then asks her to come with him to see the patient in a bed on the other side of the room. The nurse puts back the blood pressure cuff she has in her hand and glancing at the patient she turns away and walks a few paces behind the consultant toward the other patient (Field note, Site 2, Obs 24).

Although the nurse is visibly about to take vital signs, the medical request appears to take priority. Deferring tasks because of medical presence was captured on other occasions when nurses were reluctant to enter a room if a medical round was taking place. At research site 2, a nurse asked her colleague '*Have you done your obs yet?*' The accompanying nurse responded in the negative, pointing toward a closed door beyond which a medical round was in progress (RN, Site 2, Obs 13). Hesitantly they approached the door to the patient's room, peered in through the window, and, taking a deep breath, opened the door, pushing the blood pressure machine into the room. Entering together, they were in the room only moments before reappearing without the blood pressure machine (Field notes, Site 2, Obs 13). Though not necessarily justified, prioritising medical presence over measurement of vital signs is understandable given the history of power differentials between doctors and nurses. Medical dominance and nurse deference have long characterised the physician – nurse relationship (Coombs 2003).

The position of the nurse in relation to doctors was revealed in other ways throughout the observation. Du During medical rounds, the accompanying shift coordinating nurse would stand aside for the doctors, was asked to report vital signs, and was rarely consulted in relation to a patient's condition. Instead, one of the doctors was invited to report patient vital signs. For example, during a patient examination in which the shift coordinating nurse and doctors were gathered at the bedside:

> … as the patient pauses in response to the doctors questions, the medical consultant asks looking at the doctor positioned at the foot of the bed, "what are the obs", the medical registrar turns to the observation chart in the folder she holds in her hand, her finger guides her eyes along the chart as she conveys the information. "BP is ok, temp 37[2], sats 91-93". Here the consultant interrupts the conversation asking with a question in her voice "On room air?". The medical registrar glances at the observation chart saying "respirations not that high last night", she flicks to the emergency ward documentation and scans the page her look is puzzled as she says "91 - 92 [pause] on room air". The nurse stands silently to the side of the bed gazing at the patient (Field note, Site 2, Obs 17).

In addition to disruptions to nurses' vital sign practices and what were seen as power differentials, the data shows a lack of trust might exist between doctors and nurses in certain contexts. Doctors were seen checking the nurses' vital sign measurements by taking the blood pressure of a patient shortly after the nurse had done so. The notes also record an occasion when a doctor who had been called to review a patient with low blood pressure requested the blood pressure to be rechecked. He accompanies the nurse to the patient, and, standing at the side of the bed, watches her take the blood pressure as she obeys his directions (Field note, Site 2, Obs 18). The need to watch a nurse take a vital sign suggests a lack of trust.

Questions of trust and accuracy will be examined in more detail later in this chapter, but there are a number of points to be considered. 'Trust' relies on a range of factors, such as knowing the person in whom you are placing your

trust, witnessing their skill-based performance, and understanding their educational preparation, all of which is gained over time. Medical staff who do not work regularly with a particular ward nurse are likely to base their judgements on prior and current experience, not having had the opportunity to build and develop inter-professional trust (Pullon 2008). Given the history of medical dominance and nurse deference, it is probable that the professional relationship and disposition of these nurses and doctors toward one another remains complex and poorly understood.

On the other hand, the opportunity to build and develop professional trust between nurses was evident, particularly in the moments prior to hand-over between the incoming and outgoing shift. Nurses appeared to value this time to connect with each other. The chance to catch up and share news provided moments of opportunistic bonding, thus setting up a relationship of camaraderie and trust which was observed to be carried through to the ward. Nurses would also convene at the main desk and chat between bursts of activity, or share stories about their private lives during bed-making. This was most evident at the weekend, when wards were less pressured:

> Nurses gather occasionally at the desk, chatting inconsequentially for a moment then wandering back into patients' rooms. The air on the ward is one of a casual relaxed atmosphere. Peals of laughter ring out occasionally as the conversation turns jovial. The doctors who had been working with the nurses on the ward for a long period joining in from time to time (Field note, Site 2, Obs 22).

Professional camaraderie may be linked to trust that the vital signs measured are accurate and that the nurses' responses are appropriate, particularly when the results are out of the normal range. Working together for long periods also appears to result in increased professional camaraderie between nurses and doctors. The relaxed way in which nurses communicated with each other prior to shift hand-over is missed by those who are sent to assist

on the ward at times of staff shortage. Relieving nurses lack this opportunity to connect and form bonds with staff on the ward, unless they are regularly allocated to the same practice area. Also lack of familiarity with patients may inform the nurses' vital sign practices.

This section has described the clinical practice setting in which vital signs were observed. Structural factors such as ward staffing, work design, and busy throughput had significance for vital sign practices. In addition, medical and nurse relationships, and trust in vital sign practices between nurses and others all had the potential to facilitate or constrain vital sign practices.

4.2 Theme one: 'They're ok/They're not ok'

'They're ok/They're not ok' describes the nurses' shared sense that a patient's condition is acceptable or not given their illness trajectory and intuitive knowing. Knowing the patient generates understanding of when all is well with the patient and their condition. Knowing the patient also resonates with experience and patient encounters when the patient's condition was not as anticipated. Differing levels of experience and patient encounters were observed to enable or constrain care. This theme additionally highlights a process of communicating patient care between health professionals, which in practice occurred in various ways. Nurses were observed to use vital signs to communicate when patients were or were not 'ok'

When patients were deemed to be not ok, activation of the MET system was inconsistent. In one situation (described in the note immediately below), the MET was reported as activated. To set the scene, the nurses were seated in

the tearoom, chatting about the MET for a patient who had just begun to deteriorate:

> The junior nurse asks after a short period of silence "what happened?". The nurse in charge of the shift pauses before responding. "He was ok but [name] did his sats [oxygen saturations] and they were 62 [pause] so from 08.15 till 10.30 it just takes your morning away". "He has been fine but he must have been brewing something"… [pause]… "I got the Reg [Registrar] and intern to see him and then I suggested we call a MET it went from there" (Field note, Site 2, Obs 12).

It appeared from the nurses' conversation that the patient had deteriorated overnight, which the night nurses had not necessarily communicated to the morning shift. The vital signs had not been taken by the night nurses. The morning nurse allocated to the patient took the vital signs when she found the patient looking unwell. Despite the nurse initiating the MET call, after having the patient reviewed by the Registrar, the process required by the hospital was not followed until quite late in the patient's deterioration. Late activation of a MET can increase mortality (Buist, Harrison et al. 2007, Chen, Bellomo et al. 2009).

In the following episode, a nurse used her understanding of the patient to alert doctors to changes, that the patient was not ok, communicating aspects of this through vital signs:

> The nurse has taken the patients vital signs earlier than she had scheduled on her planner, advising me that she had seen the plastics team arrive and she wanted to discuss the patient's drowsiness. She says that the patient has had Endone [a pain medication] and she thinks the patient is [fluid] overloaded. She says the blood pressure is high, and the patient is "weeing a lot" all the while pointing to various charts, whilst saying that "the patient is puffy". She adds that "the pulse is ok though" (Field note, Site 1, Obs 1).

Despite the early notification of change in the patient, the doctors did not attend the patient, and the nurse, being dismissed by the doctors, shrugged her shoulders and wandered off to do other things. It appears from this

episode that the nurse, having conveyed her concern, had passed over aspects of care to other health professionals and could then move on.

Throughout the observation period, communication about care occurred in various ways. At both research sites, hand-over of care at the commencement of a new shift happened in two ways. In the first, a formal hand-over occurred, situated in a staff room located away from the ward, or delivered while seated around the main desk:

> 1400 – handover in the ward meeting room. Four nurses are in attendance for the late shift. There is casual chatter amongst the nurses as they wait for the day nurse to arrive to handover patient care, one nurse is very quiet, she tells the waiting nurses in the room that she doesn't feel very well and that she should have rung in sick, adding but she waited "as you do to see if you feel better but of course you don't and then it's too late" During handover, nurses jotted on the sheets of paper they had with pre-prepared patient names on it. When it came to patient allocation, there was lively banter as nurses named their 'not wanted' which appeared to be 'the heavy side' as was named earlier in the handover describing the wounds and dressings that had been done on day shift. The nurse who was sick asked for "a light load" as she said that she "was not well" (Field note, Site 1, Obs 5).

The second type of hand-over was observed to take place between the incoming and outgoing nurse, which was conducted at the bedside of a patient, providing the opportunity for the two nurses to look at documentation, the patient's wounds, and other aspects of care together. The nurses would walk between patients, checking charts and talking through components of care. Dual hand-over of care at the bedside between nurses appeared to vary:

> After handover, nurses went to their allocated rooms introducing themselves to patients. One nurse grabbed a blood pressure machine on her way through to the room wiping the blood pressure cuff with an alcohol wipe as she went. Picking up the patient notes before entering the room, she advised that she liked to check the obs at this time while she

> spoke to patients. No nurse seemed to be available to give her bedside handover of her patients (Field note, Site 1, Obs 5).

The capacity to visualise a patient and ask questions in the presence of the outgoing nurse assists in identifying care priorities (Chaboyer, McMurray et al. 2008) and as seen in the study, particularly facilitated medication scheduling through the use of 'shift planners'. A shift planner is a locally adapted document dividing the hours of the day into timeslots into which the times medications were due could be documented. The time intervals for vital signs would be documented on the shift planner, and crossed off as tasks were completed.

Formal hand-over was a process of providing snippets of information that could be called 'media headlines', intended to focus attention on the main aspects of patient care that had occurred in the shift. They have a news flash quality, which means that unless there has been a major change in the condition of a patient during the shift, vital signs are rarely highlighted. The outgoing shift coordinator, during hand-over to the incoming nurses, would make references to vital signs, such as '*routine obs finish at 1600*' (RN, Site 1, Obs 5), and '*another postop coming back from theatre so I guess he will be on routine post op obs*' (RN, Site 1, Obs 5). The headlining of vital signs was also observed at research site 2, where the night duty nurse handing over to the waiting day staff recounted '*she has had drops in her heart rate … but she is not symptomatic with it*' (RN, Site 2, Obs 13). On each occasion, the information was conveyed in a practical tone but without details, leaving the waiting group of nurses to fill in information gaps with their own past experiences or imagery.

4.2.1 Trust me, they're fine

Vital signs, when relayed to nurses in hand-over, are largely conveyed by the phrases '*they're ok*' or '*they're fine*', which represent a 'whole of person' or holistic view of the patient. With these phrases, nurses convey their sense of 'understanding' the patient from a whole of person perspective, reflecting their awareness of the patient's anticipated health care trajectory. This would be expected based on the everyday experiences developed in the practice setting, and through nursing patients with similar health care conditions. In this way, nurses built a sense of trust that all is well with the patient, founded upon their understanding of the patient's condition.

The way that nurses reported vital signs to each other was similar to that observed during hand-over in that the process 'headlined' any abnormalities. During routine vital sign measurement of a female patient, a nurse, seated by the side of her bed, reported the blood pressure as: '*62 on 45 … I'll check it later … she's fine*' (RN, Site 2, Obs 16). Although the nurse to whom the vital sign was being reported initially raised her voice in querying concern, she quickly turned back to what she was doing at the main desk on hearing the words '*she's fine*' (RN, Site 2, Obs 16). This patient's blood pressure was clearly abnormal (hypotension], but the decision not to use a single vital sign parameter was linked to 'something else', which fits with a more holistic view of the patient and also with the notion of trust that the vital signs are correct. There is also trust that the nurse will return to retake the blood pressure, which on this occasion did happen.

The ability to sustain a whole of person understanding of a patient is captured in the following episode, when a nurse, having taken vital signs, said that the oxygen saturations for the patient:

> … *usually sit around 90 it's currently 85 … I'm just going to look at her notes to see what they* [oxygen saturations] *usually are … the patient has been waiting for visitors all day … I'm not going to put a mask over her face when they have just gone in … I'm not really worried as she looks ok … I'll check later* … (RN, Site 1, Obs 5).

Verbalising the decision not to intervene based on the phrase '*she looks ok*' draws, on the one hand, upon knowledge of the patient, and, on the other, situates the oxygen saturations within a more holistic view. The nurse's consideration of the presence of visitors also supports the notion of whole of person thinking. On the other hand, the nurse, as a first year RN, is relatively inexperienced, and was not seen to confer with another nurse, meaning, in effect, that she may not have had the capacity to form this judgement appropriate in isolation from others. Further, the decision also ignores the policy requirement to escalate decisions about abnormal vital signs to the next most senior person on the shift. The position the nurse takes to avoid acting on the single vital sign abnormality negates the use of the medical emergency response. Warning signs of deterioration occur early in the clinical course of an acute illness, and 'headlining' vital signs does not convey the immediacy of a situation if that headlining is linked to the words 'she's [or he's] ok/fine'.

4.2.2 They're not fine, but they're ok

The observation data contain many episodes where abnormal vital signs were recorded by nurses and managed at a local level without referral to doctors or activation of a medical emergency response. While a nurse may possess a 'whole of person' view of a patient, they may be conflicted about what to report and what to ignore, particularly in the context of inaction by doctors. For example, in this episode a nurse recounts how:

> … *The patient's vital signs are interesting, he has a low blood pressure less than 80 systolic … you know the MET criteria … he seems to cope with it … he's not been well …* (RN, Site 1, Obs 3).

In this situation, the patient experienced abnormal vital signs for a number of days, which had been managed in the clinical setting by the ward doctors. The nurse, in her recounting of the episode, identifies that the patient *'is fine*' with the abnormal vital signs, but displays no sense of when to escalate care despite the MET systems in place, perhaps due to desensitisation to the continued abnormality. In this instance, the patient was not fine.

Considering this case, there was no escalation of care to medical staff with expertise in physiological deterioration outside the clinical ward where the patient was cared for as required by the governance procedures. Desensitisation to what are clearly abnormal vital signs occurred over several nursing shifts with what appears to be complicit agreement that the medical decisions at the time were delivering the correct management strategy. A reliance on medical practitioners to 'do the right thing' conveys a level of trust in their decision-making, or indeed of 'passing a problem on' for others to deal with, and this impression is reinforced throughout the data.

The nurse, in conveying the episode, did not show any sense of conflict between their actions and any internal beliefs as to whether the patient management was 'right or wrong', despite the inconsistencies between organisational governance on vital signs in deteriorating patients and the actions of the health care professionals. Once the information had been conveyed to the researcher, the nurse went back to other duties, seemingly comfortable that others were managing the patient. During the observation period, the patient continued to show abnormal vital signs, and was eventually taken to theatre for exploratory surgery. This was an example of an occasion when nurses appear to be encultured into accepting abnormal vital signs as normal for some patients.

In contrast, in other episodes nurses explicitly stated a degree of frustration regarding the apparent lack of interest medical staff placed on vital signs flagged by nurses for action. In the following example, a nurse says:

> … *What I find is that they …say the BP is 180/190* [systolic] *they are happy to sit on it … no one seems to want to make a plan* [waving her arms to emphasise her point], *we are like … the blood pressure's high and has been like this for days … it just gets handballed to someone else, the most junior doctor… it's like they are happy if it's low they will do something but if it's high they just don't want to do anything for days* … (RN, Site 2, Obs 14).

A lack of clarity with respect to what nurses consider to be required actions from medical staff in response to changes in vital signs leads to confusion as to when to escalate care and when not to. It is as if, on the one hand, medical staff complacency about vital signs is tolerated by nurses for some situations, for example, easily explainable post-surgical hypotension, and on the other hand as if the more complex, hard to explain health care problems in medical patients with their multiple co-morbidities (such as hypertension) are too difficult to deal with. Regardless of the cause, the decision not to escalate care has been accepted by nurses over time.

Recognition of the need for early intervention did not appear to be linked to vital signs in all situations. For example, the nurses discussed a number of changes in vital signs, which, according to hospital procedures, warranted calling a doctor. In this episode, the nurse coordinator of the morning shift says that a patient:

> … *has a blood pressure of 72 on 42 … the blood pressure has been dropping overnight….I suppose they should have told someone about it* [lifting her hand to tap herself on the chest] … *they told me … The night staff handed over to me but I'm not sure they told anyone … technically she is a MET call … but she's asymptomatic …* (RN, Site 2, Obs 18).

The patient in this episode had multiple signifiers, which necessitates further explanation. The decision not to escalate care had been passed through a number of nurses, each complicit in their assurance that 'the patient is fine'.

The nurses on the night shift appear to have used other subjective cues to justify their judgement not to seek medical review, as did the shift coordinator who related this particular event. Not noticing other symptoms, as was inferred by the shift coordinator, potentially reveals either a lack of understanding of physiological compensation, or a correct interpretation which would fit with a 'bigger picture' approach to patient assessment.

While a whole of person approach is valued by nurses, it does not fit with a medical model of detection of physiological deterioration. Nurses are acting by electing not to escalate care, using their personal power within the context of the situation and of their knowledge of the patient, but clinicians' recognition of and response to abnormal vital signs has been identified in the literature as a significant contributing factor in patient outcomes (Goldhill, White et al. 1999, Odell, Victor et al. 2009). The use of a single vital sign parameter to justify escalation of medical care, such as in the MET system, does not fit with the whole-of-person view nurses possess, resulting in nurses appearing at times to avoid organisational procedures such as the requirement to refer changes in patient condition to medical professionals. This is in contrast to the 'headline' style of language used to discuss vital signs, by which nurses readily report single parameter changes to one another ('*BP's a bit low but they're fine*' etc.) without referring to any other details which would convey a more holistic picture:

> Now this little lady…' says the nurse in charge of the ward '…her BP is 72/40…' she quickly adds '…but she's asymptomatic we told the doctors' (Field note, Site 2, Obs 18).

If nurses were embracing a whole of person understanding of the patient, their language does not necessarily capture this. Nor does a whole of person view marry with the nurse voicing a single vital sign parameter in reporting physiological change.

Frustration that doctors do not appear to present a whole of person view was expressed by nurses' at both research sites. During a formal hand-over, a nurse speaking of a patient with a respiratory disease recounted that:

> … *of course they* [oxygen saturations] *will be that* [98%] *when they come back from anaesthetic and they* [doctors] *say* [to the patient] *take a deep breath and the sat's come up … it's not what they* [oxygen saturations] *usually are though* … (RN, Site 1, Obs 5).

In addition, nurses expressed their confusion at activating an MET when it was futile to do so. In this episode, during casual conversation in the staff tea room, consternation was voiced about an elderly patient who received a MET call when they had experienced a vasovagal episode, with one nurse saying '*Isn't she 94?'* (RN Site 2, Obs 9). As the conversation continued, concern was also expressed for a patient with a terminal medical condition. With a puzzled look the nurse queried '*He's for MET? Why?*' (RN, Site 2, Obs 17). Each of these episodes suggests the whole of person perspective a nurse takes in relation to patient care and, to some extent, their distrust of the escalation of a MET system that relies on single vital signs as triggers and which neglects that whole of person perspective.

The observations showed that both doctors and nurses did not use a stand-alone vital sign parameter to escalate care. This suggests that an alternative assessment strategy was being used to flag patient deterioration, some elements of which appeared to incorporate a 'wait and see' approach. The trust placed in vital sign practices appears to occupy a position of conflict, in that patients are reported as 'fine' when, for example, their blood pressure is abnormal. When patients' vital signs are described as abnormal, this is not always then conveyed by nurses to suggest that escalation is required, implying the adoption of a whole of person approach which is at odds with MET escalation procedures.

4.2.3 Knowing the patient

Nurses taking a whole of person perspective had more experience, and had had multiple encounters with similar patient situations. Developed over time, this gives rise to pattern recognition, which is expressed in the following conversation between two nurses which aligns with the concept 'they're not fine, but they're ok':

> … *the patient is on two hourly obs and urine …*[says the nurse] *'* further explaining that *'… the patient has not been well … drowsy … she doesn't need them* [the vital sign checks] *now … the doctors said she would be dead in three days … but she won't …* (RN, Site 2, Obs 18).

Knowing the patient has positive connotations for the holistic nursing picture, but not knowing the patient can lead to decision-making difficulties. This was most evident when wards were staffed with nurses sent to 'help out' in times of staffing shortage. During the field work, the relocation of nurses from either the central pool or from other wards was a daily occurrence, leading one nurse delegated to take vital signs to state: '*I don't know their mobility levels …they will want more than just their obs done*' (EN, Site 1, Obs 1). Another nurse relieving on the ward expressed her lack of awareness of other patients beyond those she was allocated to care for as follows: '*…if someone asked me about, say the patient in room 8, I wouldn't have a clue'* (RN, Site 2, Obs 23).

The cultural practice of devolving responsibility for vital signs was observed at both research sites to be standard practice. The researcher saw that vital sign tasks were delegated to those who were not from the ward and who had less ability to refuse than did resident staff. For example, a nurse was smiling as she related how she would be '*allocating obs to the enrolled nurse*' who was sent to the ward to fill a gap in the staff roster (RN, Site 1, Obs 1), while another laughingly admitted that '*the student will be taking the obs*' (RN, Site 1, Obs 3). The problem with allocating vital signs is that the shift coordinator

or the nurse who is ultimately responsible for the patient may not be advised of changes in a patient's condition. This results in an inability to connect abnormal vital signs with physiological deterioration. More often than not, the data showed that abnormal vital signs were documented but not reported. The shift coordinator was not observed at either research site to check patient's bed charts.

Odell (2010) has suggested that if vital signs are delegated to others this occurs because vital signs may be considered by nurses as unimportant and insignificant when compared to other more complex nursing roles. However, the impact of not knowing the patient can be significant. For example, a nurse transferring a patient from the emergency department, when questioned by the admitting nurse about the last time observations were taken, exclaimed:

> *… I don't know I'm only dealing with the psych side of things … I don't know about anything else … no one handed over* [told me] *there was anything else* … (RN, Site 2, Obs 23).

The location of patients not usually 'housed' in that particular ward setting further compounded 'not knowing a patient'. For example, one nurse, when reporting to other nurses how busy the day had been, exclaimed '*We have 13 outliers on the ward*', explaining '*it's because of bed closures*' (RN, Site 1, Obs 4). The placement of 'outliers' on wards is a result of a lack of available beds on the usual ward on which a patient requiring admission should be placed. As a consequence, medical patients, who often possess a range of comorbidities, when placed on a surgical ward may not have nurses identify changes in their condition by means of pattern recognition.

In summary, a pattern of relationships that links to the notion 'they're ok/fine or 'they're not ok/fine' is headlined in the hand-over of care, and this is

further linked to a whole of person understanding of a patient's health care trajectory. The communication between nurses about problems identified during the taking and monitoring of vital signs conveys a picture of 'trust me, they're fine or trust me they're not fine', supporting a whole of person view of the patient. As an expression of agency, a conscious decision not to rely on single parameter vital signs is made through non-adherence to organisational governance on vital sign monitoring. The observations revealed a relationship between the nurses and the lack of trust nurses have in the actions of medical staff, as the nurse 'knows the patient' better than the doctor. There is acceptance of abnormal vital signs as regular occurrences in patient groups and in those transferred from emergency departments.

4.3 Theme two 'Knowing how: Vital signs, a task to be done'

The observation data suggest that the nature of vital sign monitoring is repetitive, routine and unnecessary for patients whose condition is stable, that is, it was often a cultural practice. Nurses appeared at ease with the measurement of vital signs; the act was completed in very short timeframes, and was repeated at times dictated by the ward. Additionally, technology supported routine vital sign practices, though nurses appeared conflicted when vital sign results were not as expected. This theme outlines the relationship between nurses' work and procedural knowledge in the taking of vital signs.

The cultural practice of taking vital signs was congruent across both research sites, with very little touching of patients noted beyond securing the blood pressure cuff to the arm and the oxygen saturation probe to the finger. The use of technology appeared to restrict nurses' physical contact with patients. Technology provided the pulse rate by measuring pulse oximetry. Technology did not provide respiratory checks which still require the counting of breaths.

On only one occasion was a pulse observed to be checked manually. In this episode, the nurse was an experienced RN, taking vital signs according to the ward schedule, appears to check the pulse because the vital signs were low:

> The blood pressure is displayed by the machine as 100 systolic and 63 diastolic, the oxygen saturations as 93%. The nurse writes this down on the chart and putting it back down says to the patient, "I will just check to see if your pulse is regular" as he places his fingers for 15 seconds against the patients wrist. Respirations were not visibly noted to be obtained. On taking the vital signs on the next patient, the manual pulse was omitted (Field note, Site 2, Obs 25).

As pulse or respiratory checks were rarely observed at either research site, this calls into question the reliance nurses placed on these components of the assessment process.

The research data thus far do not explain why nurses did not routinely measure respiration rate by counting breaths. If rates were taken by counting breaths against a timer, it was done sporadically, and seemingly without connection to any particular trigger. The literature review suggests that respiratory observations are often omitted (Jacques, Harrison et al. 2006, Odell, Victor et al. 2009, De Vita, Smith et al. 2010, Flenady, Dwyer et al. 2017), rather than being used as an integral component of patient assessment.

The process of vital sign measurement by nurses, including students, appeared to be done quickly, regardless of level of experience, and was treated by the nurses as simply a task to be done which relates to an undervaluing of vital signs. One nurse, for example, said: '*…vital signs … I don't think anyone looks at them … look at the ward round … no one checks*' (RN, Site 2, Obs 24). Further, the data record a nurse idly flicking through a magazine at the bedside of a patient while her colleague took the vital signs

(Field notes, Site 2, Obs 5), reinforcing the impression that this was seen as merely a routine, possibly even unnecessary task.

4.3.1 Relying on technology

Nurses relied on technology to take vital signs in most contexts, with the technological option taking precedence over any other form of vital sign measurement. Understanding the relationship of nurses to this technology is important, because the technology was seen to be used as a method for providing or supporting interpretation and evaluation of clinical data. In clinical practice, blood pressure is measured using devices that can be classified as manual (meaning that they rely on human judgement), or automated. Automated devices provide values that have been measured electronically (Skirton, Chamberlain et al. 2011).

On occasion, nurses would change the approach to vital sign procurement when the result did not fit the anticipated 'normal value'. 'Normal' meaning the vital sign sits within parameters that are not aligned to triggers for MET calls. When an abnormal result, predominantly blood pressure, was detected, the nurse would at times swap the automated device for a machine to manually check the blood pressure reading. Also, a pulse oximeter probe would be moved to another finger to secure a more reliable oximetry signal when none was obtained, or if a low value was seen. The blood pressure cuff appeared to cause the most problems for nurses, with the Velcro material used to secure cuff edges parting fairly regularly. Despite this situation, nurses would persevere to the point of resorting to manually holding the cuff on the arm during inflation and subsequent blood pressure measurement (Field notes, Sites 1 and 2). Students of nursing were seen to experience the same problems with technology as the registered and enrolled nurses.

In contrast, the data also reveals instances when vital sign technology was used to fine-tune patient care. For example, flow meters would be adjusted to reduce or increase oxygen supply in response to a change in the oxygen saturations of a patient being detected during 'routine' vital sign measurement. The field notes reveal such an occurrence, as the registered nurse glancing at the numerical display on the vital sign machine told the patient she was '*turning down the oxygen a bit*' (RN, Site 1, Obs 2). Not all abnormal vital sign measurements resulted in intervention. For example, a doctor on a ward round, on hearing that the last recorded pulse oximetry saturation in a patient with a respiratory condition was 96 per cent rather than the prescribed 91 to 92 per cent, asked the accompanying nurse to '*turn it* [the oxygen] *down* ' (Dr, Site 2, Obs 24). From a nursing perspective, this situation appears to have been a missed opportunity to intervene earlier based on a 'whole of person' view of a patient with a respiratory condition that would be expected to cause lower than normal saturations.

When challenged by equipment failures, nurses were observed to abandon the procedure entirely. In the following situation, the field notes record:

> a nurse walking from a room wheeling an automated machine saying '… *216* [systolic] *on 120* [diastolic] … *it can't be right* …' is advised by the shift coordinator '… *can we do a manual* …' only to be further frustrated when doing so finds the blood pressure is 98 on 60. Pushing the blood machine ahead of her as she is seen leaving the patient advising the passing shift coordinator '…*she won't keep still* …' (RN, Site 2, Obs 16).

Though the technology is used, the results are sometimes perplexing to the nurses, thus increasing the chances that the '*she's fine*' (Field notes, Site 2) attitude will be taken instead on the basis of subjective observations.

In terms of device selection, nurses would routinely select an automated blood pressure machine in preference to a manual one, even though the

manual devices were often beside the patients' beds while the automatic devices were stored centrally. This was also done in spite of nurses noting the inaccuracy of the electronic devices. This routine reliance on electronic devices has previously been reported in the literature (Wheatley 2006). In busy periods, if nurses were to utilise a manual device, they often had to search across, for example, the three sub-sites on the medical ward to locate it. In the following episode, a nurse was heard exclaiming to her colleagues '*Anyone seen the manual BP machine? … blood pressure is 80 systolic … I just wanted to check it*'. After searching two side wings of the ward, she returned pushing the machine ahead of her, saying '*These are hard to find*' (RN, Site 2, Obs 20). Addressing the link between nurses' understanding of the accuracy of vital sign technology, and knowing when to select one device over another is explained by participants as follows. They would use a manual machine *'if things don't look right in the patient … high blood pressure or tachycardia*' (RN, Site 1, Obs 7).

Reliance on technology becomes problematic if equipment is used inappropriate or is not maintained in good working order. No nurse, when questioned, could advise the researcher as to when the devices used to measure vital signs had last been calibrated, which is an important process for ensuring reliable measurements. There appeared to be an easy acceptance of using automated devices, despite nurses being well aware of their inaccuracy. A nurse exemplified this paradox when she pointed to a manual device and said '*they are better*' before continuing to wheel the equivalent automated device to a patient's bedside (EN, Site 1, Obs 1) . Understanding of the reliability of technology appears to have changed over time, with one nurse offering that *'the culture has changed; now everyone thinks the machines are accurate and never take manuals anymore*' (RN, Site 1 Obs 7). This is an example of how technology has been encultured into nurses' vital sign practice.

Only once did a nurse show a preference for a manual machine; when a patient would have been caused pain by using an automated device, the nurse chose to take the patient's blood pressure on his leg: '*He has neuropathic pain … I was just being kind to him*' (RN, Site 2, Obs 18), the nurse explained. Another nurse volunteered the following '*Nurses take blood pressures with machines and not manually … they* [pointing to an automated device] *are inaccurate …they can be out quite a lot'* (RN, Site 1 Obs 7).

However, the understanding nurses displayed of the accuracy of monitoring devices was not necessarily consistent. As this observation shows, the automated device provided higher authenticity than the manual one, as the nurse explained when her choice of device was questioned by a patient. '*No this is more accurate*,' she said, *'We used to take it with a stethoscope … this is the more modern way*' (RN, Site 2, Obs 18). As per the literature review, several small studies having found some situations in which automated devices are inaccurate (Semple, Cook et al. 2001, Skirton, Chamberlain et al. 2011). This supports the view that nurses' knowledge of vital sign measurement practices is less than complete. The nurse's comment could also be a reflection of the low value the nurse ascribes to vital sign measurements, which would be in keeping with the view that vital sign measurement is a routine, and unnecessary task.

4.3.2 Knowing the procedure

Observation of nurses' procedural knowledge of taking vital signs, and in particular of blood pressure, revealed problems. Knowing how to take vital signs is assumed in ward nurses, as it is an integral component of nurse education and was also included in instruction on deteriorating patients delivered by hospital educators. Despite their education, nurses were seen to use the same sized blood pressure cuff for all patients, regardless of body

size, and at times would place the cuff over a patient's sleeve. In only one situation was a cuff changed for a smaller size, the nurse exclaiming '*That's way too big for you!*' to the frail elderly woman as she pulled the cuff from the machine (RN, Site 2, Obs 23). In this situation, procedural knowledge was acted upon, though that this was done to ensure accuracy of measurement was not mentioned to the patient. At most times, nurses' vital sign practices were incorrectly applied, revealing poor procedural knowledge.

In another episode, participants' procedural knowledge was questioned during observation of a nurse using an automated machine. The patient looked at the nurse and asked, pointing to her dressing gown, '*What about the sleeve? My doctor always gets me to take it off*'. The nurse turned back to the patient, shrugging her shoulders, and said '*It's ok*' (RN, Site 2, Obs 21). By contrast, consider this:

> At the bedside a doctor witnessing the taking of a blood pressure over the sleeve of a nightgown impatiently uses hand gestures to the nurse to pull up the sleeve and replace the cuff on the bare arm; the nurse turning her back to the doctor partially adjusts the sleeve and places herself in a position close to the side of the patient to repeat the blood pressure, her posture suggests that she is seemingly ignoring the waiting doctor whilst continuing to chat with the patient; all the while maintaining her back to the doctor appearing to act as if he hadn't spoken (Field notes, Site 2, Obs 18).

It was as if the nurse was complying with the doctor's directions only to get the task done, perhaps certain that the outcome would be the same regardless of the process used.

The literature suggests that cuff size can influence accuracy, in that a cuff too narrow for the arm will likely overestimate the blood pressure, while the reverse occurs when a cuff is too wide (Lockwood, Conroy-Hiller et al. 2004). Also, standards of practice for blood pressure measurement would suggest

that the cuff is not placed over clothing, as this too may reduce accuracy (O'Brien and Davidson 1994) – though more recent literature suggests that no difference is detected between blood pressure taken over clothing versus bare arm (Ertug, Cakal et al. 2017). Repeatedly in the data, nurses would continue to struggle with a blood pressure cuff, and only once was a cuff size questioned by a nurse.

In summarising this theme, the data revealed examples of poor technical vital sign practices, with very few instances of a patient's pulse or breathing rate being taken manually. Instead, machine readings took precedence. Nurses' vital sign measurement skills appear to be dominated by technology, and if the technology is not readily available, the vital sign may be omitted. On many occasions the technical practices of nurses were poorly applied, and therefore the capacity of nurses to draw together a 'whole of person' picture is not supported by the data so far. In addition, there appears to be an assumption among nurses that the vital signs that have been taken are accurate, which relies on correct device selection and measurement techniques through 'knowing how' and 'knowing the procedure'. Overall, nurses' often demonstrated poor practice or technique in taking vital signs.

4.4 Theme three 'Knowing why and when'

This theme concerns nurses' understanding of the 'why and when' behind the measurement of vital signs, drawing upon the application of nurses' procedural and theoretical knowledge. This theme signifies nurses' vital sign practices when patients' condition may dictate an alternative approach to vital sign monitoring. For example, hypotension was not mentioned as a reason for using a manual device, however this method was requested by the shift coordinator on some occasions when a nurse reported a low blood pressure. In the majority of situations when hypotension was evident,

automated devices continued to be used. Fuon et al. (2000) suggest that measurement of blood pressure is challenged in terms of accuracy when the patient's condition is not as expected, such as in hypotension or hypertension, cardiac arrhythmias, or in deteriorating patients.

The data also showed that nurses relied on oxygen saturation monitoring over measurement of respiration rate. The omission of respiratory monitoring beyond pulse oximetry reflects an apparent disregard for the most sensitive and earliest indicator of respiratory dysfunction, and this is in spite of hospital-wide education on deteriorating patients. Knowing why and when vital signs are taken implies understanding of the consequences of certain actions. The data capture examples of nurses' agency that may reflect their understanding of the consequences of vital sign measurements and of subsequent intervention if this took place. The rationale behind the use of technology and the selection of vital signs to be measured is also captured. Observed in nurses behaviour is the interaction with other health professionals and the resulting impacts on nurses' agency.

4.4.1 Knowing the consequence

The consequences of not responding to abnormal vital signs were not felt only by the registered nurses. In this episode, an enrolled nurse, who had been delegated to take vital signs after being sent to fill in a roster gap, detected a change in a patient's condition:

> The enrolled nurse arrives on the ward and is directed by one of the nurses to commence taking patient observations. She scurries away toward where two machines are plugged into the wall. Unplugging the machine she enters a room and picking up the chart from its holder outside the room enters. The patient is laying with eyes closed on their back, white hair and her pale face blending into the white pillows. Her quiet breathing is noticeable as her chest raises and falls. She opens her eyes as the nurse

> calls “I’m here to take your blood pressure”. The nurse approaches the patient’s right side with the machine and glances down at her arm which is covered with a tan coloured compression device. She moves to the opposite side of the bed taking the machine with her and lifts the arm to wrap the blood pressure cuff around it. She places the oxygen saturation probe on the finger of this arm and presses the button on the machine. As the cuff inflates she glances at the machine which displays an oxygen saturation reading of 77 per cent. She says “maybe she had oxygen on and they left it off”. The slow hiss of oxygen can be heard escaping from the tubing placed under the patient’s pillow. Walking to the right side of the bed she tugs at the tube and places it in the nostrils of the patient. She walks back to the other side of the bed and begins to take the tympanic thermometer from the basket on the machine and places it in the patient’s left ear. The patient barely moves and keeps her eyes closed. The oxygen saturations slowly climb ..90 per cent..91 per cent..93 per cent..95 per cent. The nurse writes in the chart and leaves the room (EN, Site 1, Obs 1).

The patient had recently been attended to by a registered nurse for hygiene purposes. The episode shows how the nurse connects the patient’s surgical procedure (mastectomy) with the procedure of vital sign procurement and also reveals one potential consequence of omitted care (loss of oxygen).

In contrast to this episode, an instance of not understanding the consequences was observed as a nurse took the blood pressure of a patient who was in obvious pain. When cautioned by a physiotherapist that sitting the patient on the side of the bed to take the blood pressure was causing more pressure on the patient’s intervertebral disc, thus increasing pain, the nurse ignored the physiotherapist, turning her back to continue documenting the vital signs she had just taken (RN, Site 2, Obs 10). The effect of increased levels of pain on the blood pressure was not considered consequential by the nurse. When the nurse left, the physiotherapist lay the patient back down in the bed.

Nurses were observed, on occasion, to link vital signs, in particular blood pressure, to nursing procedures such as the provision of medications. After

taking vital signs and noting a blood pressure of 160 on 85 (hypertension), a nurse advised the patient '*I'll keep an eye on your blood pressure … because you didn't get that tablet*'. With the patient's medication chart in hand, she sought out a doctor who was on a ward round, and asked '*Shall I give this one* [pointing to a medication on the chart]?' (RN, Site 2, Obs 23). In this situation, vital signs were provided with value in terms of a whole of person approach to nursing care. The consequence of not providing the antihypertensive medication was evident in the action of the nurse. As a counter-point, though, another nurse reported that not every one of his colleagues would link medications to blood pressure, as this conversation between himself and a student nurse reveals:

> The student nurse glances up from the folded pages she has pulled from her pocket. She looks toward the male nurse who is sitting reading notes, saying "What drugs would you check the BP before giving". He looks up from the page toward her and says "Beta blockers [pause] captopril maybe [pause] anyway I check [pause] not everyone does though". The student looks at him, nods and replaces the notes in her pocket (RN and SN, Site 2, Obs 22).

Blood pressure medications appear to be the most common site of connections being drawn between vital signs and the patient's health condition and the consequences of not acting correctly. This episode, told to the researcher during routine vital sign procurement, reveals such a connection being made:

> The ill patient from the previous day who required careful monitoring and intravenous fluids has moved to another room. She looks brighter, smiling at the nurses and giving over her arm for the blood pressure measurement. The nurse taking the blood pressure reports the patient's blood pressure was better than yesterday. Explaining, "Her BP had been low in the ED and on the ward but the night nurses gave the metoprolol" shrugging her shoulders says "lesson learnt". Then "I always tell students to check the obs before giving out the pills" (Field note, Site 2, Obs 9).

Nurses and students of nursing were observed speaking with each other regarding vital signs, and physiotherapists were also observed referring vital

signs to nurses. Conferring in this way implies that there is an understanding of the nature of the problem and of what should be done about it, which links to the consequences of action or inaction. For example, a nurse was heard to murmur to a patient:

> …Y*our blood pressure is a bit low … I'm just going to check with someone about it … You have had your I.V.* [intravenous] *fluids taken down … that might be the cause of your blood pressure* … (RN, Site 2, Obs 18).

The nurse is clearly establishing a relationship between the abnormal vital signs and a possible cause. The consequence of the problem is later revealed, after the nurse, consulting with the shift coordinator, is told '*They're* [vital signs] *to be expected. She has cancer of the lung*' (RN, Site 2, Obs 18).

The connection between vital signs and consequences were also established in other situations. A nurse seated at the main desk, writing in the medical records, overheard doctors discussing the marked drop in blood pressure between a lying and standing value commented *'No wonder she is dizzy when she stands up*' (RN, Site 2, Obs 18). However, in practice it was observed that despite a patient on occasion complaining of dizziness when first mobilising, lying and standing blood pressures were only performed when ordered by medical staff, thus calling into question whether nurses placed any value on vital signs as informing their own patient care, or whether they instead relied on other cues to inform their actions. For example, after hearing a physiotherapist report that a patient's blood pressure had dropped as he sat her up to get out of bed, the nurse turned to the student working with her and advised '*We might wait* [to get her out of bed] *until after she has had morning tea*' (RN, Site 2, Obs 8). This episode draws attention to the link between medical conditions and interventions. However, the patient's blood pressure was not rechecked prior to the nurses later mobilising the patient.

The relationship between educational preparation and vital signs, which would presume a degree of reflexive understanding of the link between actions and consequences, is raised in the data. Nurses with additional qualifications or more experience may have contrasting views on vital sign measurement. As a nurse recalled '*No one checks* [vital signs]. *Physios do; they check the saturations* [oxygen]. *I do; I am renal trained, so I look at blood pressures*' (RN, Site 2, Obs 25). This suggests that specialist knowledge may accord greater understanding of the consequences of vital signs.

Nurses were observed to use casual staff room conversation to share and question their understanding of vital signs. In this example, nurses on their meal break were discussing the numerical values of vital signs for a sick patient who had been administered a blood transfusion on a previous shift. The nurses appeared to struggle to explain the meaning of blood pressure values and their significance to the patient's situation:

> … "*His blood pressure* [systolic] *was like 120, 90, 80, 60 and I thought that's it* …". Another nurse responds "*… I know it happened to me, it's like you stay with the patient for the first fifteen minutes and its 120, 110, 90, 80 ….But next time it was 120 …"* [with a shrug] "*…What's going on* …?" (RN, Site 2, Obs 15).

This hints at a relationship between reflecting upon vital signs and knowing (or not) the consequences to the patient should actions be taken or omitted.

4.4.2 Knowing when: 'passing the problem on'

Nurses in the study would convey abnormal vital signs to doctors and each other in varying ways. Proactive measures were observed. In this episode, for example, a nurse was relating her concern to a patient in her care stating '*Your blood pressure is a bit low. I am just going to check with someone about it*' (RN, Site 2, Obs 19). Finding the nurse in charge of the shift, the situation

was conveyed in a casual, short hand manner, which does not necessarily convey the level of concern the nurse was experiencing; the medical staff did not attend to the issues raised and the nurse did not follow up any further.

Conveying information to doctors regarding vital signs was seen as a form of '*passing a problem on*' rather than as working collaboratively to address the situation. For example, on finding a low blood pressure reading, a nurse exiting a patient's room declared to the shift coordinator seated at the main desk *'Blood pressure is 90 on something. Doctor was there. She knows*' (RN, Site 2 Obs 20). The nurse shrugged her shoulders as she put the automated machine away and went to morning tea. No nurse was seen to enter the room to recheck the patient or to follow up with the doctor; neither did the doctor attending the patient report back to the nurse with any instructions. Handballing or passing on vital signs delegates responsibility to another person, and thus, in some sense, conveys a sense of a lack of ownership of vital signs by nurses. This is seen in the following episode as a nurse conveyed to the After Hours Nurse Manager for the ward that '*Now this little lady, her BP is 72 on 40, but she's asymptomatic. We told the doctors. I've told everyone so they all know*' (RN, Site 2, Obs 18).

Disconnection was also evident in the communication chain between doctors and nurses, when a nurse requested that a doctor review a patient due to an episode of hypotension. The episode conveys a sense of lack of knowledge on the part of the nurse of what is in fact an abnormal vital sign. The low blood pressure was detected during routine morning vital signs, and the abnormal reading was conveyed to the nurse in charge of the shift who advised to the reporting nurse to call medical staff. Having paged the doctor, the nurse continued with her work:

> The nurse caring for the patient with the low blood pressure carries her sheets and towels down the corridor toward room 16 to wash a patient, the shift coordinator passing her as she goes (Field note, Site 2, Obs 18).

The story picks up around an hour after the phone call and after the blood pressure has been reviewed by the doctor responding to the call. The doctor requested a new blood pressure to be taken which showed a systolic blood pressure of 75mmHg. The patient is lying in bed reading a book seemingly unperturbed by the visit from the doctor. As the doctor walks away from the patient's room, the nurse asks

> Nurse *"…What blood pressure would you like to be called for ….?"*. The doctor responds *"… 70* [systolic] *yes 70 …".* The nurse requests *"… Can you write that in the notes so we know …"* (RN, Site 2, Obs 18).

The doctor, after conferring with someone on the phone later requested for intravenous fluid therapy to be administered. Neither practitioner acknowledged the organisation's MET escalation policy which governs action when a vital sign parameter breaches the mandated value, as the vital sign clearly had.

On another occasion, a nurse had spent some time attempting to have a patient who she was concerned about reviewed by medical staff, and the nurse raised concern about the medical staff's inaction. After considerable delay, the patient was seen by the doctor. The researcher's field notes later record the nurse saying: *'I wish they* [doctors] *were more proactive. I wish I would have rung earlier*' (RN, Site 2, Obs 18). Clearly anxiety was expressed after the event, and the deferred actions were questioned, though the delay is not explained in the data. In both of the episodes above, the nurses involved had been filling in gaps in the roster, which may have reduced their agency.

This theme has identified that in the main, vital signs were seen to be measured and documented without generating any follow-up actions. This would be expected when vital signs are within normal parameters. What is not clear is why *abnormal* vital signs were accepted as 'normal' for the patient and therefore tolerated by nurses. Nurses understanding of the consequences of action or inaction is presented in the context of their agency. Communication between health professionals was seen to occur, but nurses' unease about patients was not always actioned in a manner that relieved their concerns. The actions of the nurses occurred in each research setting against the backdrop of cultural vital sign practices.

4.5 Theme four: Knowing the culture

Ward cultural structures had the potential to enhance or impede nurses' agency about vital signs. Nurses would speak of the routines on the ward, and the researcher saw that they were to play an important role in measuring and scheduling the measurement of vital signs. Ward routine was explained by a nurse as:

> … *When we come on we do the drugs then we do the showers and the washes, we do the obs anytime from ten till about eleven … in the afternoon the late staff do them when they come on about two thirty then that's it … There's not much to do in the afternoons ….* (RN, Site 2, Obs 25).

With routines come rituals, which are those practices that are played out on a daily basis in the context of the culture in which they are performed (Lee 2001). Specific to vital signs, the 'obs' were taken on a relatively consistent schedule in each research setting, and that schedule was rarely questioned. Nurses would schedule vital sign collection on their planners along with medications to be administered. A nurse who initially queried the ritual around vital sign measurement recalled:

> … *As a student I used to wonder why we did obs at ten o'clock, two o'clock and so on … patients can be outside and yet when they come back in we do obs on them … a temperature is ok as it's a surgical ward but …. oh well it's only my opinion and what do I know* … (RN, Site 1, Obs 4).

This is an example of enculturation into the rituals and routines of the ward despite questioning routine practices. Students of nursing were also observed to adopt the practices of the ward with respect to vital sign measurement, and were not observed to question either the frequency of measurement, nor the fact that vital sign tasks were routinely delegated to them. Thus, conveying a sense of each nurse and student attempting to fit into the time driven routines of ward life.

Time was interwoven with observation taking at a number of levels in the clinical setting. On one level, vital signs appeared to be taken at times dictated by the operative or medical condition of the patient and by the routines of the ward. On another level, time played a somewhat different role in that it rarely consciously interrupted the routine practices observed on the ward. When asked why the vital signs had been taken, a nurse reported '… *I just did it* [vital signs] *'cause I was bored* …' (RN, Site 2, Obs 18), conveying a sense of the value placed on the vital signs as a task.

Maintaining the status quo through persisting in traditional practices appears to be a cultural phenomenon, but variation in the routine scheduling of vital signs was observed in this fieldwork. Following hand-over:

> The nurse went into her room picking up the notes before entering saying she liked to check the obs at this time while she spoke to patients. Checking the charts of patients she said that she would not do their obs as they had been done at 1300. She would do their pulse and temperature at about 1630 and do a full set of obs later in the evening because there was no need to do them (Field note, RN, Site 1, Obs 5).

It is not known how the nurse determined that vital signs were not needed, as the shift had just commenced and little information had been conveyed during the formal hand-over. The practice of omitting vital signs was not limited to one ward:

> As the nurse emerges from room 15 she raises her hand to pump an alcohol solution into it. She turns and approaches the nurse she is working with in that section of the corridor, leaning close she murmurs "I took his obs but left the sats". The other nurse nods and they separate (Field notes, Site 2, Obs 15).

It is perhaps the drawing together of years of experience and the holistic vision as previously mentioned that informs this practice. In this example, the nurse has shown some ownership of the vital signs, which was not often seen in that research setting. However, ownership of vital signs was also challenged, as expressed in this quote from a nurse when asked 'What are nurses' actions when taking vital signs?' She responded:

> *… Obs … What do nurses' do with them … They document and go …* (RN, Site 2, Obs 23).

This reflects the perspective of one participant. On most occasions the data capture nurses taking and documenting vital signs before moving to the next patient. This, perhaps, reveals the lack of thoughtful processes that go into vital sign procurement, though this is difficult to determine through observation alone.

In summary, cultural practices such as rituals and routines reduce nurses vital sign agency. Discretionary omission of vital signs was seen to occur, despite organisational governance requiring nurses to take a full set.

4.6 Chapter summary

The chapter has presented the qualitative data as captured in the observation field notes, and has shown that nurses interact with the culture, context and reality of practice of vital signs in a number of ways. The clinical setting in which vital signs take place are busy with high acuity patients, and the interruptions dealt with by nurses are many, varied and constant. Nurses struggled with poorly applied technology and scarce resources to support their vital sign practices. The casualisation of the workforce, and using relieving nurses to fill gaps in the ward staffing roster, contributed to the non-recognition of the subtle signs of physiological deterioration in patients. This may be a result of an inability on the part of substitute nurses to connect with usual ward practices, making identification of deterioration and then communicating these findings more challenging. The inability to connect physiology to vital signs may also be due to lack of exposure to patterns of health behaviours. The capacity to build up a repertoire of usual patient illness trajectories may be lost when a nurse is moved from ward to ward, making it difficult for them to know their patients.

The observation phase has painted a picture of the role that nurses play in the gathering of patient data expressed as vital sign measurements. The ritualisation and routinisation of vital signs is clear from the field work, as is the fact that nursing has sustained routine practices despite published research calling for change. Knowing how to measure vital signs is an important theme, one which challenges the role that single vital sign abnormalities play in detecting subtle signs of physiological deterioration, particularly when those signs are relegated to routine and ritual and *delegated* to others.

The procedural act of vital sign procurement reveals contrasts between some nurses, who met expectations for the technique of vital sign measurement, and others, who did not. This may be a result of the task of vital sign measurement being perceived as routine and repetitive - poor technical practice was captured during vital sign episodes. Delegating vital signs to the nurse least likely to know the patient also supported the routine nature of vital sign practice. The lack of trust by doctors for nurses' vital sign practice was also observed. The limited value placed on vital signs as a result of lack of trust, adherence to poor practice, and delegation to others is thus exposed for critique.

Conveying that the patient is 'ok' or 'not ok' relies on knowing the patient, and this is an important finding of the present study. Knowing the patient and their illness trajectory conveys a 'whole of person' perspective in concert with the patient's anticipated health care journey. A nurse is regularly exposed to variations in patient vital signs during the active and recovery phases of illness, and thus it is necessary to build a deeper repertoire of experiences on which to base practice. Through knowing the patient and conveying a sense of 'they're ok' or 'they're not ok', the data suggest that contextualised pattern recognition is influencing the actions that a nurse takes when responding to vital signs, and this is combined with a whole of person view of a patient.

In contrast, the short 'headline news' approach when communicating vital signs between nurses conveys a sense that nurses view the main story of the patient journey as insignificant. Using single vital sign parameters to signal a change in patient physiology supports this impression of nurses' perspective, particularly when the MET is not activated. Knowing when and why vital signs are necessary connects altered patient physiology to the consequences of action (or inaction). The lack of MET activation for an abnormal vital sign

appears to be linked to a whole of person approach to care, which may be an example of nurses' agency in action. Nurses appeared willing to pass a vital sign abnormality on to others, particularly when it did not support their assessment of the patient as determined by the determination that 'they're not fine, but they're ok'.

The data show responsibility for abnormal vital to have been devolved through the passing on of the problem by 'telling the doctor', but the response was not as expected of individuals in an organisation with a long-standing response system in place. This aspect necessitated analysis on a number of levels in the next phase of the study. The data report a pattern of relationships that link to the notion of 'trust' between the nurses in the study. There is trust that the patient is 'fine', and there is also an apparent presumption (and therefore trust) by nurses that the vital sign as taken is accurate, which relies on correct application of procedures and correct analysis of the situation. The data also reveal a lack of trust between nurses and doctors, particularly when exchanging information on vital signs.

Knowing why, when and the consequences of vital sign measurements reveals that there is a disconnection between what is known should occur under the MET system and what actions are then taken, sometimes across multiple shifts. Agency is often expressed by avoiding MET activation, and by passing the problem on to others. The avoidance of MET activation is sometimes continued by doctors, with whom the nurses engage on a daily basis, and this appears to reinforce the impression that vital signs are seen as unimportant.

What is missing from the data is clarity about the relationships between agency, organisational structures such as the MET, and the ward culture that

nurses use to explain their vital sign practice. The use of a single vital sign parameter to escalate care conflicts with nurses' exposure to regularly changing vital signs in patients, as would be expected during their recovery from illness. The inclusion of interview data will strengthen these results so that a richer picture can be presented for critical realist interpretation.

Chapter 5 Describing nurses' vital sign practice: Interview phase

> *…Well if you don't, we're going to call a MET call. That's what we have to do* (Carl, RN, Y0.6).

The previous chapter highlighted how structural factors impacted upon nurses within the context of the ward and their agency for responding to vital signs. Contextual, organisational and structural factors such as the MET and the recently implemented ADDS and doctor-nurse power dynamics which also related to nurse agency were revealed. This chapter describes the data gathered from nurses' reflective insights in response to interview questions. The chapter reports nurses' reflections upon the contextual and organisational factors which influenced their practice in order to explain the interplay between nurses' agency and social structures observed. Customary practices are described as they bear on getting the job done within the confines of time and other ward activities. The ways in which social structures and agency are linked to nurses' experience, alongside ward culture and recognition of and response to physiological deterioration are detailed.

The experiences of the research participants and how they constructed their own meaning of vital sign practices are described, as is the way in which these meanings influenced their actions in response to vital signs. Participant's quotes are identified by participants' profession in brackets and. years of experience. Nurses' reflection on their vital sign practice informed the study, highlighting the role that an individual's reflexivity plays in mediating the effects of social structure on purposive or intentional action (Archer 2003, Archer 2007). Reflexivity consists of reliving past experiences and imagining future scenarios (Archer 2003, p.133).

Through analysis, three themes related to the context and structural factors of the nurses' environment and to the customary or encultured practices that influenced their vital sign agency were identified. The participants also reported on their experiences in the ward setting and in specialty practices that influenced the measurement and subsequent interpretation of vital signs. How vital signs affect the identification and response to physiological deterioration is presented with respect to participants' actions. Examination of the interplay of cultural factors revealed not only the micro-level behaviour of individuals, but also collective or shared knowledge as it was applied through the exploration of customary practices. The meanings that nurses ascribed to the practice of vital signs as learnt through experience and multiple interactions with others within the structures that governed those interactions is also described. The chapter concludes with a summary of the interview phase.

5.1 Nurses' vital sign practices: Context, culture and structural factors

This theme deals with nurses' relationship to vital signs through customary practices, which related to time and ward activity. Customary practices are those accepted by nurses in the context of ward work and were seen in the observation findings of 'knowing how'. Nurses spoke of the customary practice of vital sign measurement as '*getting the job done*', an attitude founded on a long history of routine activities that are accepted in ward culture. Examples of 'getting the job done' included adhering to schedules of time particular to a ward, working within a task-based nursing framework (where nurses are assigned to clinical tasks, such as vital sign measurement), using technology, and documenting vital signs without necessarily considering the implications. The binary role that vital signs play in the assessment of patients in terms of their condition and trajectory is highlighted in this theme.

5.1.1 Customary practices as influenced by busy wards

Nurses spoke of the practice of doing vital signs which, on analysis, was dictated by the particular customs of the ward in which they worked and by ward activities. The taking of vital signs when patients were admitted into an acute care setting was considered a routine activity:

> *So we have a routine of doing vital signs, so we're…well if you're in an acute setting. So it's about saying let's monitor our patient, so it's a form of monitoring, and then we can put that into a routine of, ok, in a 24 hour period, when we come on a shift, then we're going to put them into a timeslot. So it's just I think something that we get used to be doing from a routine perspective* (Lucy, RN, Y20).

Surgical wards were more likely to routinise vital signs in terms of taking them at predetermined (set) times, as indicated by the phrase '*routine postop obs*'. Lucy explains why vital sign measurements may be required more frequently in the postoperative period:

> *….post theatre we've got to do them much more regularly, because they're* [the patient] *at a high risk of deteriorating …* (Lucy, RN, Y20).

A number of participants brought up perceived differences between activities in hospital wards, describing medical wards as less predictable than surgical wards. Krystal (RN, Y15), in conversation which arose from the question related to any situations she had experienced where vital signs have been misunderstood, or misinterpreted, stated:

> *...compared to surgery, where the nurses are very fast … I suppose because surgical is much more predictable in outcome and medicine is much – well, we don't know, we're trying to work out what's wrong with this patient …*

This quote suggests the difference between the fast pace of the surgical ward, reportedly due to the predictable nature of the patients' illness trajectory, which contrasts with the more measured, investigative nature of a medical ward. Further, medical wards manage patients with complex and

sometimes unfamiliar conditions which may challenge the notion of 'routine care'. Medical patients do not lend themselves to easy standardisation, usually because they experience a complex range of comorbidities (Parker 2004).

Participants also described the relationship of ward activities to vital signs as competitive and distracting, which detracted from their capacity to measure vital signs. Frank (RN, Y6) highlighted the challenges faced with balancing ward work and vital sign practices:

> *… Well it's so busy. It is just, it's just the time factor, you know, it's so busy to take a full set of vital signs even though, you know, the blood pressure cuff might take 20 seconds to pump up and you might count your resp rate for 15 seconds, it's still the whole process of actually finding the equipment, setting it up, talking to your patient, why you're doing it, and then, you know, even if you do take them, then, can you find the chart to write them in. It's all those other factors; it's not just purely strolling up and taking some vital signs…* (Frank RN, Y6).

This quote reinforces the observation of time used up in finding equipment and other resources to support their vital sign practices.

In contrast, Hattie (RN, Y14) challenged the notion that being busy was an excuse, claiming that a customary or cultural practice component overlays the concept of constant busyness:

> *… I have to be honest and say I'm not sure that we're any busier than we necessarily have been … I think we think we're busier. I think it's a psychological culture thing and I think people constantly tell you that's a busy unit. You start thinking yeah, right. It is really busy. It's probably that. Maybe that reinforces the issue that we're very busy and we're time poor and we can't get everything done …* (Hattie RN, Y14)

Lucy (RN, Y20) echoed this sentiment:

… I think it's as a culture, like as a society, like we laugh in our house, we sit down at the dinner table, and I say to my husband, "How was your day?" And I say to him, "You're not allowed to say busy." And even my kids will say, "We're not allowed to say busy." Because we're all busy…

When describing cultural practices, Peter (RN, Y20) explained the routines of the surgical ward:

… it's partly very stressful because of the way the ward's run and partly because there's a culture of doing things quickly, efficiently and at a pace; that's the culture of the ward that is how the nurses there work…

In addition, busyness and ward routine, including time and problems like missing clinical equipment, were raised as important structural factors which inhibited the ability of nurses to measure and respond to vital signs. The impact, however, that ward activities had on the capacity of nurses to respond to the measurement of vital signs was varied:

… I think a lot of the time we've got the habit of just writing vital signs down and not actually looking at them properly. You know, again 'cos you're in such a rush you may just think, oh yes scribble that down, oh they've got an ADDS score of 3 [abnormal]*, okay well, they seem to be okay at the moment so I'm just gonna' leave it. You know, or not even thinking along that far, just actually writing them down and not actually looking as well…* (Frank, RN, Y6).

Frank's account highlights an apparent disconnection between each component of vital sign practice, namely their measurement and subsequent interpretation. Frank linked this to ward busyness, which is understood to be related to customary practices; because the patient is not considered to be physiologically deteriorating, the nurse adopts a wait and see approach that will not require additional action/work.

Regardless of the ward setting, the measurement of vital signs needed to fit into a wide range of factors the participants considered to be important, and competed with patient and clinical activities such as washing, feeding,

ambulating, and ward rounds or procedures. Nurses discussed performing these tasks with others, which would involve the allocation of vital signs to one nurse while the other performed different duties. As Sue (RN, Y20) recounted, vital signs, in the ward environment, were integrated into the context of the team's practice, but not necessarily the practice of the individual nurse.

> *… It's called collaborative practice on one of the wards. To me its task based nursing. So one nurse will do the obs for the whole half a ward and one nurse will do the hygiene and one nurse will do … because the loads are so big, its task based nursing …*

Task-based nursing appears to support customary vital sign practices, and the scheduling of vital signs in the context of perceived ward busyness. The nurses were also conscious of competing pressure to perform tasks in addition to the measurement of vital signs, and of how '*important things*' may be missed during task-based nursing:

> *… if you just knew you've got to do 20 sets of obs, I don't know whether my brain, I'd be thinking oh god I've got to get this done quickly, and I don't know any of the patients because I haven't -- so that's where I think it can be a little bit not patient focused at all because I think it's a task end. Have you got time to check what they were before? I mean you should because it's right in front of you, but yeah …* (Sue, RN, Y20).

Frank (RN, Y6) discussed the role that time plays in the gathering of vital signs and their interpretation:

> *…I think the biggest thing with that is just the time. Just everything's getting, you know, there's just so much to do in one day that you sometimes miss the important things…*

In each of these responses, the nurses describe the customary practices with which the culture of the wards is imbued. Time will be discussed as a structural element in the following section.

5.1.2 Customary practices influenced by time

The taking of vital signs at scheduled times is interwoven with not only customary practices, but also with the recently introduced organisation-wide ADDS policy. At the time of the first phase of the study (observation), there was limited organisational policy in place to dictate the scheduling of vital sign measurement beyond a process for flagging signs outside normal parameters through the MET system. Historically, measurement of vital signs appears to have been based more on ward-specific customary practice, as some of the nurses advised that there had previously been no written policy or protocol available to guide their actions:

> *I think it's part of the culture to do QID obs … When someone's post-op, its protocol, I guess, but there aren't any written protocols that we could find* (Priya, RN, Y15)

The lack of written policy on when vital signs were to be measured led one recently graduated nurse employed in his first placement on a medical ward to say: '*I think vital signs have become a bit of a task. Like 10 o'clock is vital signs, kind of when you do them* ' (Carl, RN, Y0.6). This is despite the addition of ADDS:

> *Unless I'm worried, the ADDS chart is pretty good now for helping us to understand better times. Unless I'm worried, I'd leave it to normally a six-hour block, but if I'm worried I will do it whenever I like, I don't worry about the ADDS chart, half-hourly, hourly, whatever it may be* (Bea, RN, Y3).

As a nurse with experience, we see in Priya's response the beginning of acceptance of the lack of protocol and the customary practice of nurses taking vital signs, and this leads reasonably to the inference that customary practices may compensate for lack of protocol. Carl's words further supports the concept of customary practices by linking ward culture to when vital signs are taken. Bea describes how the time intervals for vital signs can be changed, depending on the nurse's level of concern. Examining the relationship

between vital signs and customary practice in the absence of written guidelines establishes how nurses' micro-level behaviours were enacted on the clinical wards.

Not only were vital signs performed routinely and perhaps without conscious deliberation as 'a job to be done', their taking was also influenced by time of day:

> *… We're probably not so good of a night especially at time, especially with new patients… we often tend to just let them sleep and don't do anything which can be a bit problematic by morning time ….* (Bea, RN, Y3).

Bea went on to say that '.. *I like to let them sleep because sleep is pretty important for them, they don't get much around here'*. Here we see an example of where vital signs are relegated, in terms of priority, according to the patient's needs, with patient comfort being placed above the need to monitor their condition.

Meg (RN, Y20) tells us that:

> …*Timing seems to be historical. It seems to be that we have always done our obs at six o'clock in the morning, and then at ten, and then at two. So, that doesn't to me say what are we trying to actually achieve here, it's just that this is when we did it because that's when we've got enough time to do it and so we can get that job done, and that's not really driven by the patient's condition and what their particular needs are …*

The timing of vital signs therefore seems to be understood by nurses as a matter of tradition, rather than of addressing the different needs of the patient through patient-centred care. This draws attention to nurses' focus on the patient, and how their health status may be assessed. It also suggests a lack of professional agency to organise such a big task into something that has clinical reasoning.

5.1.3 Using technology to detect cues of change in health status

In the observation phase, nurses were observed to select the automated devices over manual. The interviews also described the reliance on technology. Carl (RN, Y0.6), a recently graduated nurse, showed some awareness of the use of technology and how it has been instilled into nursing practice:

> *… I think it's become so technological that you put on a cuff. You press the screen and it does it for you. You don't have to do it manually unless you want to or you're concerned and you want to verify it. You don't check pulses manually hardly ever. It's just change. I'm new but I know that years ago they checked pulses and did do manuals* [blood pressure]*. I think people are just relying on technology and* [not] *to actually have to stand there and look at your watch and look at their chest…*

Carl, as a nurse with minimal experience, was reinforcing acceptance of using technology for vital sign measurement. Nurses new to clinical practice may only know technology. Krystal (RN, Y15) describing a deteriorating patient situation she had experienced, whilst working with another registered nurse on a medical ward, tells us:

> *… As I got in there* [the patient was slumped in the chair with breathing difficulties]*, I did that, I took the vital signs. It was an interesting situation because, as I said, I was supervising someone trying to take – I actually did take over that situation and we did the set of vital signs, which we were unable – really hard to ascertain, so getting from – the idea of getting someone to use a manual machine, that had never used one before … it was an RN so that was interesting too…its interesting how many of them do actually freak out when I say ,"Let's try it with a manual, and see if it's easier,"* [responding with],*"Oh, I've never done that before, that's a bit tricky."*

The time saving purpose of nurses' use of technology is also raised. Hattie (RN, Y14) cautioned: '*I think we rely heavily on machinery. Absolutely we do now. I think that's just come down to everything is time saving, time saving,*

time saving'. It appears that the use of technology saves time, which can then be spent on other nursing tasks in the context of a busy ward environment.

Despite the emphasis on time saving, the interview data reveal pockets of resistance to the use of technology, though these appear to be associated with nurses' level of experience. Dusty (RN, Y20), a nurse with 20 years' experience, showed a more active awareness of how technology has replaced 'hands-on' nursing, as well as of the important role a nurse plays in measuring and interpreting vital signs:

> *… one of the things that I don't like is this no touch, because I really like to go up, take the patient's hand, hold onto their hand while I'm doing their observations, chat to them, because I can still be counting their respirations. I can also be feeling their pulse so that if I get a reading up there that says 80 or something and I can feel this really bounding pulse, I know that the machine's not – I'll go back and recheck physically with a manual machine, because I don't trust technology on its own. Technology doesn't do it on its own …*

This conveys how older more experienced nurses understand the importance of hands-on nursing care in detecting cues of physiological change which can be missed by using technology alone.

Missed cues through trust in or reliance on technology were raised on other occasions, with participants questioning the accuracy of vital signs as taken by machines:

> *… there's only so much a machine can tell you and it can't tell you if it's an abnormal heart rhythm. If they're cold, pasty, clammy and … they* [machines] *can't tell you ...* (Hattie, RN, Y14).

Replacing hands-on vital sign measurement with technology was connected in particular to respiratory monitoring, with the physical act of nurses taking respirations replaced by measurement of saturation of pulse oximetry. The taking of respirations is an important part of vital sign monitoring. Lucy (RN,

Y20) advised that *'To be honest, we've stopped – it's uncomfortable and it's a bit weird to start staring at someone's chest with your watch*'. Further, when discussing the taking of respirations, why they may be omitted and the reliance on using technology, Opal (RN, Y20) said:

> *… I would be guilty of the same thing, because it's very boring apart from anything else, and almost meaningless when it's in that range* [normal] *isn't it. I think too because people are always going right just quick, do everything as quickly as possible. The other thing I suppose, this is really cynical, is that they have to count it themselves. So well some of them* [nurses] *look at me like I've got two heads when I say go and do a manual blood pressure …*

As nurses with significant experience in a variety of clinical settings, Hattie and Opal are drawing upon the cues that a patient can convey, and by adopting a hands-on approach they are signalling that other information is being gathered beyond a digit obtained from a vital sign. Also implied is the concept that technology is but one tool with which to gather health status information, and that what is required is not just a number. This knowledge is being lost to a new cohort of nurses. Also, there is something here about knowledge decreasing and not increasing.

This suggests that vital sign measurement is increasingly perceived as a skill routinely performed, and as something that was taught but may not necessarily be understood nor related to the whole person receiving care. Instead, vital sign practice is relegated to being little more than a number to be recorded. For example, Judy (RN, Y20) stated: *'For some people, it's just a doing thing and then they put a number in the box*'. Sue, a registered nurse with over 20 years of experience, expanded on this when she attempted to articulate the relationship between understanding vital signs and what this means for the patient's health: *'They don't understand the importance of – if that's going to change what does that mean internally for the patient*'. This point is connected to understanding the physiology underpinning vital signs, which is taught as a component of bachelor's degree courses, and as part of

professional development on deteriorating patients for nursing staff on medical and surgical wards (which may not be sufficient to address what is required).

Carl, a recently graduated nurse, confirmed that some nurses esteem vital signs more than others: '*I think some nurses get a bit blasé about doing vital signs … other things are more important*' (Carl, RN, Y0.6). This leads to practice conflict. Opal (RN, Y20) challenged nurses' relationship to the practice of vital signs when she claimed that

> *… We know that it actually is important to get things right and to do the right thing, absolutely the right thing by your patient … I think this is important, so I just don't think some of them realise what an important job they have, or what a responsibility they have to themselves in the community and the patients … they just don't get it …*

It seemed that the lack of understanding of the importance of vital signs was puzzling to some nurses, as they attempted to rationalise how an episode of physiological change could be overlooked. Here, Bea (RN, Y3) relates how a patient's deterioration had been missed:

> … *and she'd only done the training* [education on the deteriorating patient] *not that long ago, so she understood what was right and what wasn't right for vital signs, without having the ADDS chart as well telling you that wasn't right …* (Bea, RN, Y3).

Despite education on the deteriorating patient, nurses commonly omit respirations or oxygen saturations via pulse oximetry if the equipment is not immediately available, indicating other mechanisms are generating nurses actions. Therefore, cues of patient deterioration are still missed and the increased reliance on technology may be one structural aspect that contributes to this. Lack of experience in nursing practice, and lack of previous exposure to physiological deterioration both appeared to offer partial explanations for missing patient deterioration.

5.2 Experience, ward culture and vital signs

The data indicate that nurses were more able to not only question the knowledge gained from vital signs and the frequency of vital sign measurements as they increased in experience level, but also to offer solutions to problems to do with measurement frequency, as well as how vital signs may relate to the interpretation of physiological deterioration. The interviews also show how enculturation occurs on hospital wards, and, in particular, how vital sign practices become routinised despite experience. Quinn (RN, Y20) suggested that:

> *The frequency of it, I sometimes think is driven by history almost. If you have an unwell patient, and you're worried about the patient, you'll do the obs more frequently. But the next person coming on might say well they only need to be on QID obs, that's all they're on…Then it's not as rigid but I think it's driven, we have these, I think we have certain protocols, but it's driven by history. A lot of it's not driven by your assessment, and you do get a bit of resistance if you go outside those boundaries.*

Quinn is reporting the tension that experienced nurses feel when they deviate from routine vital sign practices. Also, the difficulties experienced nurses may face tying vital signs to patient assessment if this is done in a way that differs from routine cultural practices.

In terms of how vital sign practice experience develops, Quinn went on to say:

> *… It feels that it's almost like the more junior staff when they first come out, if they're still on such a learning curve, that the vital signs are part of that learning curve …* (Quinn, RN, Y20).

The researcher understands this to mean that the nurses needed repeated exposure to changes in vital signs to inform decisions to act. The nurses also considered experience to be important to the nurses in providing a foundation on which to build care:

> *… I think when you are taught them* [vital signs] *it's a skill and I don't know whether you're actually relating it to the patient … so I would just be doing a blood pressure and I would be writing down my numbers …*(Sue, RN, Y20).

Experience with vital sign practices builds with time and exposure. Vital sign practice experience is connected to the capacity of the nurse to make clinical decisions in response to a patient's health status. These decisions not only concern the measurement of vital signs, but also the actions required to address them.

On the other hand, it should be noted that in the research population the capacity to express agency in spite of relative inexperience appeared to be subsumed within practice, with nurses becoming encultured to the ward in which they practiced:

> *… Being a graduate …at that level when you're worried about everything or you've got this, 'she'll be right' attitude, or you rely very heavily on the senior people around you…when you're a junior and you're being told by medical staff or by senior nurses not to worry about this not to worry about that, it doesn't take long before you stop worrying about it. You go well, this is acceptable … Then that becomes the practice, even though you know what the protocol is or you know what the research is. It changes our practice when the people around us are not following those …* (Andrew, RN, Y10).

In Andrew's reflection, he begins to correlate experience and how it changes over time, routine practice and how it informs, if it goes unquestioned, the accepted 'normal' for those working on a ward. This suggests that nurses are encultured to ignore abnormal vital signs if they do not have the knowledge, experience or agency to decide how to act upon them.

5.2.1 Experience and vital signs

Routines of vital sign practice appeared important to those who had less experience and who therefore perhaps had less capacity to express agency to challenge structural factors. Edgar (RN, Y0.6), a new graduate working on his first ward as a registered nurse, rationalised the routine of taking vital signs and how it supported his view of the patient as follows:

> *…Well I think you need… like, you know, you could do QID* [four times a day] *in a sense and do them like hour after each, but you're not getting a full snapshot of how they're going in a sense. So, you know, spreading them out gives you the opportunity to capture them at certain times in the day, how they're scoring* [on the ADDS chart] *and what their vitals are ... but, you know, as a whole QID is really good because you get those snapshots…*

Edgar explains how taking vital signs at set times may provide an opportunity to detect deterioration by revealing trends. In the data from the observation phase, participants did not routinely report trends in vital signs as being linked to physiological deterioration, nor did they elaborate on how data trends were linked to patient assessment. Instead they reported single vital sign changes to support a change in condition and subjective cues in 'knowing the patient'. This indicates that while trends are considered important by some, they still might not inform vital sign practices. It may be that Edgar was beginning to learn how to know patients and their illness trajectories, a skill which builds with experience and time spent with patients.

The routine of operative cycles on the surgical ward for common conditions may lead to a degree of familiarisation that promotes confidence. Such confidence, however, was described by Andrew (RN, Y10) as a double-edged sword:

> *… I would say you've got a group of experienced nurses who are really experienced and really cautious … then you've got a group of experienced nurses who think they've seen it all … and they've got all the answers. So I think that experience can be double edged sword …*

Andrew's statement highlights the influence of experience on contextual and customary vital sign practices.

Quinn (RN, Y20), in the following quote, relates how vital signs are used as an assessment tool, which contrasts with the encultured and organisational practice of routine vital sign taking. This appears to lead to variation in nurses' practice:

> *… on the surgical ward it's quite obvious that you're looking for various conditions, whether it's a postoperative haemorrhage or whether it's a sepsis, which all are reflected in vital signs. Or they can be like preoperative baseline assessments. So they're purely for the nursing assessment that we can then analyse and then liaise with the doctors. So that's why I think the need for it is because it assesses the patient*.

Nurses' educational preparation is a factor in their experience, and this has effects on their vital sign practices. Meg (RN, Y20) suggested that the knowledge gained from specialisation influences the actions of nurses and medical staff, and this affects vital sign interpretation and subsequent patient management. Specialisation refers to further specialist training and work in a specialist practice area, and it appears that it provides nurses with a degree of confidence to respond, to advocate for the patient, or to challenge customary practices. The importance of specialist practice was also raised by Krystal (RN, Y15): '*I remember, because I've a neuro-surg* [neurosurgery] *background, there's lots of monitoring and things*'. In addition, Lucy (RN, Y20) recalled how specialist work emphasised the importance of vital signs for her:

> *… I remember working in the haematology* [department]; *it taught me that vital signs were really, really important, that's when I first was drawn to realising it was more than just putting a cuff on and pressing start, because if you didn't pick up the changes, and sometimes they were very subtle, you could put a patient's life at risk …*

Lucy highlights the challenges of interpreting subtle vital sign changes, and how omissions can lead to failures to detect potential deterioration. The participants also connected specialisation to the process of clinical judgement in detecting deterioration, which may or may not relate to the interpretation of and response to vital signs:

> *… if things are a bit off, or I've got a gut feeling, it's not purely based on vital signs. It's from assessing the patient a little bit deeper than what we do as nurses most of the time. But I did do HDU* [high dependency unit]. *I did the HDU course so I think I picked up a lot of those skills. Whereas a lot of other nurses need to be prompted to do that...* (Frank, RN, Y6).

Nurses reported that specialist nursing practice informed their assessment of patients, and assisted them in interpreting and applying vital sign practices. In addition, regardless of specialisation, their experience assists them to make decisions about vital signs in the context of differing patient situations and ward settings.

5.2.2 Agency and organisational structures

Analysis thus far has shown that the perpetuation of customary practices, such as rituals, routines and cultural practice, forms the foundation for ward enculturation. This is just '*how it's done*' (Meg, RN, Y20), and this perspective affects all staff and the way they work. Cultural factors influence how nurses work, and this may relate to the expected pace of specific wards, as well as to other structural factors such as organisational policies and medical dominance. In attempting to explain the relationship of the nursing culture on the ward to perceived organisational policy-driven care, Meg (RN, Y20) suggested that:

…it's driven from the top. It's definitely driven from the top. It's driven from the medical directive of this is what I want to know and this is how I want to do this. It's driven from the top in nursing as well in that the nurse managers and the educators aren't then saying well hang on a minute, we should be looking at this in a broader scope. They allow their staff to practice in this way and that builds a culture, and once you have got a culture, the young people come in, they get told this is how it's done, and that's where it perpetuates …

When policies were known to be in place, nurses appeared conflicted in how these policies might affect independent nursing practice. Andrew (RN, Y10) expressed the dilemma faced by nurses when dealing with changes in a patient's condition, and how policies, whether written or not, can quickly imbue nursing culture:

… If I had someone who was quite symptomatic… someone who was dizzy and dry and all of those things, then you act above that. That's perhaps one of the downfalls of the system is that I don't know that people act above and beyond it when we ought to. It becomes, it serves a minimum and then it becomes the standard, which is a risk with systems I think... (Andrew, RN, Y10).

In addition to policies, working relationships in clinical areas were identified as affecting the measurement of vital signs. During data analysis, organisational staffing policies were found to be associated with the measurement of and response to vital signs, as well as to the educational preparation of the nurses. The relationship between nurses who routinely worked on the ward and those who were sent in as relief to fill rostering gaps was evident in the interview transcripts, and also in the observation data, both of which showed that medical and surgical wards were reliant on casual or relieving staff on most days. Relieving staff were described as being expected to take on the regular duties of the ward nurses, which included the measurement of vital signs. Sue (RN, Y20) described the expectations and the tension that can arise:

> *… Well see you would hope that the person that you're delegating to would have the same thought processes as you but obviously that doesn't always happen. I mean see that's just the reality of the workforce. You can't just do it all yourself so you have to* [delegate vital signs] ...

Sue's statement highlights the delegation practices that occur in hospital wards, and how nurses must rely on one another to undertake tasks as delegated.

The educational preparation of the nurse to whom vital signs were delegated, or who had been sent to relieve a staffing shortage also affected vital sign practice:

> *… I think as a casual nurse, there's not a lot of time invested in your education, because you're just there as a gap filler ... I didn't get a lot of the ongoing education, that if you're a permanent part of the team you probably would have got, and I didn't seek it either, I just kept travelling and moving on, and going from experience to experience* … (Lucy, RN, Y20).

Nurses who were casually employed were seen as not necessarily possessing the same level of education as nurses who were permanently employed on a ward, and who thus had access to ongoing professional development:

> *… Because of the way the staffing is at the moment, there's a lot of relieving staff … I'm guessing their education isn't as thorough as ours … or their awareness maybe isn't as heightened as ours and they probably need a bit more education …* (Rose, RN, Y20).

Bea (RN, Y3) confirmed this when rationalising why vital signs were omitted by a nurse who had been allocated to care for a patient who, at the end of the shift, was found to be clinically deteriorating: '*One is a Pool* [casual nurse]*, who should know a bit better … but she's a casual*'. The observation data show that a large number of casual nurses are engaged on each shift, which may reduce the quality of care.

5.2.2.1 Casualisation and agency

Casualisation of the workforce also appears to increase the likelihood of missing patient deterioration, but the root cause of this increase may be lower levels of education among casual workers. Despite identifying a possible deficit in the education of relieving nurses, ward nurses appeared willing to abrogate their role to those sent to a ward to assist with care. Rose (RN, Y20) elaborated:

> *… Relieving staff, they are actually registered nurses and they are supposed to have done certain things. Whether they have or not I don't know. We can't generally be responsible for their education …*

Responsibility, in the nurses' view, appeared to lie with the person who decided on the action in question:

> *… You would be responsible for monitoring your patient's vital signs and then acting accordingly based on their charts and based on your knowledge and then if you delegate that and again it depends if you have your own patient load or whether your team is or whether, whoever is physically doing it, they are the person responsible to do something, act, or notify somebody else ….* (Sue, RN, Y20).

Sue's explanation is incomplete; it does not fully account for the relationship between the person who delegated the action and the nurse charged with undertaking it. It appears that once care has been delegated to another, then the relationship has ended and there is now individual ownership of the issue, as Hattie (RN, Y14) partially explained as follows:

> *… I think that comes back to the cultural perception of what vital signs are and it's a task and you can do task x for me and that frees me up to do something else ...*

5.2.2.2 Vital sign practices and agency

Aside from taking ownership of vital signs tasks, experience appeared to make no difference to nurses' capacity in terms of the number of signs they

could take per day. Before the implementation of the ADDS policy, vital sign measurement appears to have been dictated by routine practice, meaning that none of the participants discussed either who ought to prescribe, them, or how often they ought to be taken. After the ADDS was implemented, which occurred during the interview phase, vital signs were required to be taken at six-hourly intervals for all patients, unless medically prescribed changes were made. The six-hourly intervals resulted in some conflict, as Judy (RN, Y20) mentioned: '*Sometimes I think we over-observate* [sic]*'*. India (RN, Y4) felt similarly: '*Well, you know, some people don't need all the obs that we do; I don't think*'. However, resistance, which took the form of omitting by virtue of omitting required vital sign measurements, also took place, as Andrew (RN, Y10) explained: '*As a general rule people have got a myriad of excuses about why that wasn't followed or why that wasn't done*'. This suggests that nurses use their personal power to dictate when vital signs are taken, regardless of organisational structures. Additionally, the requirement for six-hourly vital sign measurements for patients frustrated experienced nurses, who sometimes felt that a patient may not require them. This resulted in nurses working around the system within the bounds of their personal agency.

In terms of experience, ward culture and vital signs, the nurses in the study described the conflict between organisational structures and encultured practices, which were found to govern their measurement of and response to vital signs. Each of these matters raised a number of individual and collective challenges. Such as how nurses worked together also affected vital sign practices, and how this influenced their detection of deterioration is further discussed in the next section.

5.3 Vital signs, physiological deterioration and clinical judgement

Nurses spoke of their experience with physiological deterioration of patients, and of how vital signs influenced its detection (or not). Every participant had a compelling story about vital sign practices, and these stories revealed the complexity of clinical work (though this complexity varied with the experience level of the nurse telling the story). Although each nurse had experience working with patients whose condition changed, one nurse cautioned that *'I don't know that a lot of people do see rapid or severe deterioration a lot, so we don't expect …like 90 per cent of the patients will be stable*', and went on to say, when describing an unexpected episode of deterioration, that '*the vital signs were not yet showing the clinical deteriorations*' (Lucy, RN, Y20). This indicates that exposure to situations in which vital signs, whether overtly or subtly, reflect deterioration, may not necessarily provide nurses with the evidence they need to support clinical decisions:

> *… Deterioration can be so slow, so that you don't actually see it. You can see a patient today and you can see them tomorrow, you see a big difference. But from hour to hour, it can be very much a different scenario… it can be a gradual dip down and that's where, again, taking the vital signs would often show* [the deterioration] *…* (Dusty RN Y20).

Dusty implies that regular exposure to the patient and their condition may assist detection of deterioration, which may not be indicated by early readings, and in fact regular exposure may hide deterioration from the nurse. However, regular contact with a patient may not be the lot of nurses who are rostered to different patients over various working shifts, or of casual nurses sent to a ward to fill roster gaps. Each of these circumstances may increase the number of missed opportunities to detect physiological change.

Andrew (RN, Y10) related the difficulty in gaining experience in connecting vital signs to physiological deterioration:

> *… People don't go to work every day, expecting somebody to have a code blue* [life threatening medical emergency], *because it actually doesn't happen very often …. Even METS … they don't happen very often either, not to an individual practitioner, working those shifts, they don't happen and we don't see what happens to patients afterwards...*

When raising the issue that nurses do not see the outcome for the patient after an urgent medical review, Andrew highlighted the lack of opportunity to follow through with a patient throughout the course of symptom identification, recognition, response, and subsequent outcomes. This results in ignorance of the cascade of events, as care for deteriorating patients is often transferred to others and the outcome is only known by those 'others'. The 'other' in this setting is more often than not a collection of critical care personnel in the setting to which the acutely ill patient may be transferred, and in which deteriorating patients may be cared for days or weeks. It may be some weeks, too, before a patient recovering from a health crisis is returned to a ward, if at all. This may a nurse's capacity, regardless of experience, to understand the consequences of not identifying and responding to deterioration. For nurses, the longer term consequence of physiological deterioration may very rarely become apparent – that at least appears to be the case among the study cohort.

5.3.1 Vital sign practices as influenced by patient status

The matters raised thus far point toward a mismatch between prompt response to vital sign changes, patient-centred care and routine, customary practices in the setting of complex ward conditions. Complexity and unfamiliarity may lead to more routinising of care, and to difficulty interpreting vital signs when the condition of a patient changes. For example, Meg (RN, Y20) compared medical and surgical wards in terms of the impact that routine and familiarisation have on the practice of taking and interpreting vital signs. In particular, she suggested that adhering to

customary practices may obscure the information yielded by the vital signs themselves:

> *… I think the surgical wards, where they are doing post-obs and they are applying that to their patient's condition and they're deteriorating and things like that, I think they do that a lot better there … and in some of the medical areas … it does tend to be a bit more of a … let's get this job done and it doesn't seem to matter what the observations say ... So, they're not - often nurses aren't using that information really to determine whether what they are doing is the right thing to do or not ...*

Using vital signs to determine if safe, quality care is being provided (or not) for the patient brings the information upon which nurses base their actions into focus.

The practice of taking vital signs changed with years of experience. Lucy, a registered nurse with 20 years' experience, recalling her first involvement with vital signs as a novice on a surgical ward, explained '*For me, I think obs*, *they were quite a routine, you just did them, and I really don't think I had a great understanding*'. Further:

> …*What I see from the other ward nurses, in some areas it is more pronounced than others, is that the vital signs are a job to do and they are not using it as an assessment tool. They're getting their job done …* (Meg, RN, Y20).

The concept of '*getting the job done*' regardless of patient condition does not fit with patient-centred care, which is underpinned by a whole of person assessment, and this led to one nurse questioning the relationship between these approaches. Hattie (RN, Y14) believed vital signs to be:

> *… probably a very task-orientated thing … where everyone got vital signs every four hours regardless of whether you were going home the next day. That's probably a bit of over monitoring. Or you know, whether your condition was worsening. Potentially you weren't picking it up because you were only looking at them every four hours. That comes back to having*

> *that visual recognition of what a deteriorating patient looks like and then thinking I need to intervene and do vital signs…* (Hattie, RN, 14).

Here Hattie was moving beyond routinisation, introducing the notion of putting a larger, perhaps more visual, picture together of the whole person and their condition, rather than relying on vital signs alone to drive care. Hattie revealed her agency in having the patient and their condition drive care, which, if vital signs are not carefully considered, would conflict with the customary practice of taking vital signs.

Other participants also mentioned considering a 'whole of person' picture of the patient, but also that it is not something all nurses do: '*I mean you can actually see that watching for trends and things is not second nature to a lot of nurses*' (Krystal, RN, Y15). Krystal may be presuming that considering the whole patient, in the context of their condition, is a perspective that is developed in nurses over time, and through exposure to changing patient conditions.

5.3.2 Using vital signs to support detection of physiological deterioration

Experienced nurses acknowledged the role that vital signs play in forming an overall assessment of a patient's condition, as opposed using them solely as numbers to guide care. Lucy (RN, Y20) points out that vital signs are '*a form of assessment, it's putting everything into the picture of what's happening clinically with the patient*', which, for Lucy, '*can sometimes tell us what's happening from a stability or instability assessment, and so we get driven to do that depending on what's in front of us*'. Here Lucy was referring to the use of visual cues to ascertain or confirm suspected developing problems rather than relying solely on numbers, and this reflects an integrated approach. Bea (RN, Y3) advised that vital signs are:

> *… a really good way to understand what is going on with your patient. We're really good as nurses at visibly seeing what's going on, but that's not always indicative… I've had a few patients who were very very sick but they come across quite well … but it gives us an indication of what's going on …*

Bea also described how she assesses a patient's condition more on visual cues than vital sign numbers. Taking an approach less focused on numbers is also linked to having worked in a specialised area of nursing. Bea (RN, Y3), who works in a ward which has patients with renal conditions, said:

> *…as you go on you interpret more of it by sight …as a student …we would have been shocked if you were working with renal patients with systolic of 70 but to us it doesn't matter ... he's sitting there, he's chatting away … you really start to look more holistically rather than … on the numbers*…

The organisational structures, such as ADDS, do not account for health conditions, but they do allow for modifications to be made for individual patients. This relies on a prescription from a doctor, which in itself the nurses considered to be problematic. Carl (RN, Y0.6) advised, in relation to ADDS individualisation for patients, that:

> *If they score a certain number, legally we have to follow the guidelines set out. I remember we had a CF* [cystic fibrosis] *patient come up and generally CF's, a lot of them have low blood pressure, have high respiratory rates and have low oxygen levels. She came up to the ward without modifications on the back* [of the ADDS chart]. *So she was scoring like a six and one of the nurses called the Registrar and the Registrar got quite annoyed that she had to come and do the modifications. Well if you don't, we're going to call a MET call. That's what we have to do.*

In this case, the nurses were placed in conflict and their agency curtailed by a lack of malleability of structural rules.

Not all nurses relied on vital signs in the same ways:

> *…To me, the vital signs are one aspect of what else is happening with the patient, so I personally don't look at them in isolation, and I don't ever make a decision based on just vital signs, so they're one portion of assessment ...* (Judy, RN, Y20).

Frank (RN, Y6), relating his experience of working in a specialty area, expanded upon this concept:

> *…There were the little things, you know, like her feet were more puffy than the first day that I met her. Her eyes looked really dull, you know, and in conjunction with the numbers and the vital signs she had, I just thought something was gonna happen and it did …*

Frank describes drawing upon other physical cues of patient deterioration to guide his decision-making. His description suggests a good knowledge of physiology, which relates to reflection upon experience with similar situations, and to specialist education.

Nurses spoke of gut feelings and of sensing that something wasn't quite right with a patient leading to an escalation of care:

> *… and it's hard to know in the moment how much you should be pushing for things because you're never a hundred per cent sure that the patient isn't, you know, going in the right direction. And it's funny, like nurses talk about this gut feeling, but it is multiple things that make up that gut feeling, whether or not it's what the family member says to you or you've had a similar experience, you know, before, but just with this lady I could just tell that something was gonna' happen …* (Frank, RN, Y6).

The notion of a gut feeling was considered difficult to articulate to medical professionals, and at times to other nurses caring for the patient, which resulted in a sense of disquiet in the nurse. As Frank (RN, Y6), again recounting his experience working in a specialty area explained:

> *… there was a patient who I think was day 4, day 5 postoperatively and had, using the ADDS chart we could tell that she was, you know, declining. All her figures were declining lower and lower and she was just hovering with that ADDS score of 5 to 6 which is not uncommon for a patient after having open heart surgery. Everyone, including the doctors and the other*

nurses just were happy with how she was. They were happy with where she was. She looked good, you know, she didn't look that compromised at all. I expressed my concerns to the doctors multiple times. I even went to the Nurse Unit Manager and said that, you know, I don't really feel like this lady is progressing. She's not getting better. And certainly at day 4, day 5, we should be seeing some improvement … we kind of ended up getting her reviewed by the right people, and she ended up going back to ICU after tamponading [bleeding into the pericardium] *and they think that she was having a slow trickle* [bleed] *so it was just one of those things I think, that, you know, we could've pushed and pushed a little bit harder.*

Frank was describing how experienced nurses can put together a composite picture of numbers and other physical cues to interpret vital signs and thus detect deterioration. In the above episode, this process was also connected to having worked in an area of specialty practice, and to how nurses' understanding of the patient is different from that of doctors.

Understanding appeared to change with experience moving the nurse beyond a reliance on numbers:

… it's hard, I think definitely not, in the beginning when you start being a nurse. But as your judgement gets a bit better I think you start thinking along the similar lines as a doctor. My little sister's an intern this year and we talk about vital signs very differently. I think sometimes nurses can purely talk about vital signs and not be mindful of other things happening as well. Whereas the doctors, you know, once they review a patient they tend to look at the bigger picture of the whole system, you know how things are kind of influencing other things. But as nurses we can become very focused on one vital sign. I think the more, definitely coming out of Uni I didn't look at vital signs how I do now. Yeah I think I was just very naïve in that I really just cared about what numbers, what they were, you know, were they in the right parameters? Whereas now, you know, I can, I have a bit more background knowledge, I kind of know a little bit more on how it affects different things and as well I think in terms of …. compromising the patients, compromising. When I first came out of Uni for the first three or four years, I just would always say, oh you know, that's the patient compromising. Not really knowing what that actually meant I don't think. But now I have a better understanding of that ... (Frank, RN, Y6).

Nurses in specialist wards understood vital signs differently from doctors. This was particularly evident in doctors who were not experienced in the specific field, which could result in professional conflict in terms of securing an action in response to deterioration. It is also important about how they talk about them.

Experience informed nurses' understanding of patient deterioration, and assisted them in making decisions about how to respond to changes in the patients' condition. Nurses considered decision-making about vital sign practices to be important, but this importance often seemed to be superseded by the task's routine quality among the less experienced.

5.3.3 Experience, clinical judgement and vital signs

Nurses spoke of issues when using clinical judgement when dealing with patients about whom they were concerned. These judgements were closely aligned with level of experience, and also with knowing the patient. For example, Sue (RN, Y20) discussed the potential for conflict in decision-making between older (more experienced) and younger (less experienced) nurses: '*okay so the junior staff will follow specifically what it* [ADDS] *says. Older staff members will think, okay but yes that patient is this, this and this and so not do any of the things*'.

In terms of agency, nurses spoke of feeling that their decision-making authority had been taken away from them with the implementation of the ADDS, though it is arguable that they did not have such capacity before the policy was implemented either. Lucy (RN, Y20), an experienced nurse, reflected upon the way nurses felt about the implementation of the ADDS policy, saying it was:

… very much an attitude of that you're taking away our nursing ability from us which I find is very interesting because it's pretty well documented that we kind of didn't have the ability beforehand. If we had it we wouldn't need this. So clearly there was a deficit going on somewhere…

The difficulties nurses face in using a system that mandates how often vital signs are to be taken and directs any subsequent action were described as undermining the role that clinical judgement plays in patient care. Recall Sue's (RN, Y20) view that junior nurses would follow the ADDS process while more experienced nurses would draw upon patients' illness trajectory to inform their vital sign practices. She added: '*…and that bothers me a little bit*', before going on to say:

… and even if I think I know that this extra step of doing this [vital signs] *again in ten minutes isn't necessary, I will do it because for some reason it might. I've got my own judgements and my own expertise… but I'm going to do it just because ...*

Bea (RN, Y3) similarly admitted:

… I also skip a few steps, I really am looking at them [the patient]*, I'm not doing one thing at a time, everything is connecting now for me … the students are doing it one step at a time … we're already six steps ahead ….*

This is important. It indicates that recognition of patient deterioration depends largely on identifying abnormal vital signs as well as on recognition of other patient cues, thus further linking experience and assessment to patient-centred care, rather than a reliance on vital signs alone.

For example, Sue (RN, Y20) recalled drawing upon other cues to determine if the patient's condition had changed:

Yeah so physically and certainly if you've nursed them before you know what - well yesterday you weren't confused and it doesn't say in the hand-over that you're confused, that you're not really making much sense to me at the moment or you're slightly aggressive or you're shivering or you're

grimacing in pain. So there's lots of physical cues that I would use to think, okay not right, I'm just going to do some obs.

The above quote suggests the difficulties nurses face when attempting to combine two systems (patient centred care and ADDS) which are so contradictory in nature. Participants related that, historically, nurses were taught to treat the patient and not the number:

… I can remember being taught at Uni, that you shouldn't treat the numbers you should treat the patient. So when you see someone who's got a low blood pressure or a high heart rate, that if the patient looks fine and they're talking to you and they're happy, you're putting it into context with everything else, then that's using your clinical judgment to build a picture… (Andrew, RN, Y15).

Numbers are obviously a significant element of vital sign interpretation, but the act of interpreting is fallible:

… Yes, I mean the numbers are good, we need numbers and we're taught in Uni the numbers, we have in our heads, what is acceptable, but there's both sides of acceptable ... (India, RN, Y4).

However, Nic (RN, Y15) pointed out that '*using the whole "what's normal"* [approach] *is bad when you are talking about individuals*', which for Nic, meant that an individual patient may have their own 'normal', and that not everyone may fit into the one box of 'normal vital sign values'. If nurses were to rely solely upon vital signs to inform their clinical judgements, then any subsequent action based on that judgement might be misled. Other cues may need to be considered, but these, too, are open to misinterpretation.

Sue (RN, Y20) described an occasion when cues were misinterpreted. On that occasion, she withheld a medication:

I think the more experience you get, the more you see what someone looks like if they've got low blood pressure … I'm predicting what would happen if I gave that [medication] *and so therefore I want the data before I'm*

going to give something that's going to affect the vitals and the patient outcome. I did once with a student withhold medication. Well not considering that perhaps the medication had a dual purpose but, in my opinion, I still did the right thing because yes it was going to lower the blood pressure. So I used the vital signs to predict my course of action.

In this situation, Sue believed that she was providing safe care by omitting the medication, but her assessment in this instance was incorrect – the medication had been prescribed for a different reason – thus showing the fallibility of nurses' clinical-reasoning in some contexts.

A nurse's experience is also a factor in their interpretation of vital signs and their use of clinical judgement, as Rose (RN, Y20) explained when describing her use of vital signs following her graduation as a nurse:

… Well, because when you first come out it's all about numbers and you're not looking at the whole person, you're just looking at the numbers and it's like "oh gosh." But as you become more experienced and you've got a few kicks in the backside from the interns, you have learnt to put not only the numbers but the clinical judgement in as well, I think…

The fallibility of clinical judgement when interpreting vital signs was also discussed, particularly with regard to the practical aspects of vital sign measurement. Though this, again, may have been related to the ADDS process, Sue (RN, Y20), an experienced RN, suggested: '*I think the new charts are good because you're dumbing it down, you don't actually have to think*'. In contrast, Andrew (RN, Y15) related how, when interpreting vital signs:

… you find a way to justify in your mind that that's okay. It's only when you really can't that you start to go ah, maybe we should worry about that. Because I think that happens, the blood pressure will be low, and we'll say well let's do it on another machine, or the sats [oxygen saturations]*, you know it happens all the time. Until you get the number that you want, you chase the numbers that you want, yeah we'll do it on the other arm we'll see what it is. Then when it's okay, we go oh that's okay then. Not well here we've got these two sets of you know, it's crazy. There's something about human nature that says we're optimistic, we believe that really*

*they're well if we've got poor information it's probably wrong. Which I think is an issue... (*Andrew, RN, Y15).

Aligning clinical judgement and vital sign measurement is made more problematic when this is integrated with complex practice and nursing experience. Andrew presents a picture of inconsistency between what is seen, what is interpreted and the different image the vital signs present. Frank (RN, Y6) described his interpretation of how vital signs are used in clinical practice as follows:

… I just think people just want the numbers within the right range and you know, a lot of the time we don't actually take into consideration what's normal for that patient, which is a hard call but because the ADDS chart really takes that away from us as well because it's saying here's the parameters, this is what we're gonna' aim for, you know …

Frank is highlighting how vital sign practices and organisational structures can conflict with agency.

5.3.4 Clinical judgement and agency

Ignoring what may be normal for a particular patient may mean that a nurse is placed in a difficult situation: should they work with or against the organisational systems? This may result in taking a path of least resistance. Lucy (RN, Y20), felt that:

… as nurses, we seem to go down the path of least resistance, like we want the vital signs to be okay, and when they're – the machine says it's not, then we think the cuff's wrong, or the thermometer is wrong, or the battery is flat. If it's not giving us what we need, and the patient looks well, but when the patient doesn't look well, and the vital signs machine tells us that everything's fine, then we say, Oh, but your blood pressure's fine, and you're afebrile [no elevated temperature]*, despite the fact that you look bad…*

Frank (RN, Y6) summarised the interplay between vital signs, the contextual nature of practice and clinical judgement:

… I think the importance of them has kind of improved in my head, and my knowledge of them has improved, but I think as well that I'm less reliant on them. I don't know, after seven years of working as a nurse I feel like I stand at the end of the bed and pick up deterioration, you know, so it's that clinical judgement that initiates me to go and actually take the vital signs …

Frank was describing how the capacity to act is built upon experience gained over time and through exposure to patient deterioration. This provided him with the confidence to act, which reflects an expanded knowledge base and an ability to recognise patterns of illness from patient cues.

In contrast, the nurse with less agency is more reliant on the ADDS, in spite of possessing assessment skills and the procedural capacity to activate a MET based on vital signs. Carl (RN, Y0.6), a recent graduate, recalled an episode when following the ADDS step by step assisted him to activate a MET response:

… the last time I kind of was concerned about it it's going to stick in my mind because it was a very long day. The night nurse didn't have time. She was too busy to do like the 6 am obs. So I came on at 7.30 and I did this gentleman's observations and his blood pressure was something like 80…I checked either arm just to see if it was, it was the difference... At that point it's MET criteria and it deteriorated into the 70s and throughout communication with the doctor we called a nurse in. Several things happened and it was very stressful.

Lack of experience here contributed to Carl's agency, in that the vital signs should have triggered a MET call without delay. On balance, however, the ADDS provided an alternate route for the inexperienced nurse to make the MET call, which is particularly relevant when the intern lacks experience.

The ability of nurses to express agency and to challenge the traditional practices which govern and surround the routine measurement of vital signs was brought into focus by Priya (RN, Y15):

> *… I think the older, more experienced nurses can see that they* [vital sign measurements] *don't necessarily have to be done as often as what they are done, especially when patients have been here for a little while. But I think … people are reluctant to make changes with that unless they're actually told they don't need blood pressures. Yeah, I think it's just part of the routine…* (Priya, RN, Y15).

Inability to express clinical judgement in order to change the frequency of vital sign measurements was described by one experienced nurse as '… *Frustrating … I personally sometimes find it frustrating* …' (Judy, RN, Y20).

From time to time, nurses would relate stories that revealed pockets of resistance to the organisational structures in place guiding vital sign management. They also experienced communication challenges with medical staff. When a vital sign is recognised as abnormal, the nurse must contact medical staff, and it is they who prescribe appropriate medical therapy. There is potential for misunderstanding between the different classes of health professional in relation to the actions needed, which may lead to frustration for the nurse as well as to inappropriate therapy for the patient. Gemma (RN, Y3) described how, confronted with the low blood pressure of a post-surgical procedure patient (less than 80 mmHg), and acknowledging that the patient required medical attention, was concerned when:

> … *I did phone the doctor because I was obviously concerned but I ended up getting the Reg* [Registrar] *who was in theatre on the phone and just not interested at all, didn't have time to deal with this, and that was really… I found very disheartening because I guess the patient required a … well what I would think … would be bolus* [of fluid], *I really thought I think this patient needs a fluid bolus, but with the doctor not really being on-board and not really interested in the blood pressure of 80 … but was very happy just to say well, not my problem, why are you bothering me about this …*

Nic (RN, Y15) reinforced that view: *'The doctors put us in difficult situations at times*'. Here, though, experience may play a stronger role in enabling the nurse to argue their case. For example, Nic (RN, Y15), a nurse with many

more years' experience than Gemma, faced with a similar situation, (a patient's low blood pressure) took stronger action:

> ... *"Look, this person's in MET criteria,"* [Nic said] *and they* [the medical staff] *said, "Yeah, we know, we know, we know," and I said, "Well, what are we doing about it?" And she said, "Oh, we've given 250" of something and I said, "Okay, but it's MET criteria, so unless you're going to come now, I'm going to have to make a MET call,"--well, I sort of apologised for it and they were like, "Oh, so you're threatening us," and I said, "Well, sort of, yeah." "I'm sorry, but," and I guess the ADDS chart gave me a little bit of power to actually do that …*

Despite Nic expressing her agency in challenging medical staff, she also showed her reliance on the organisational structure in place at the time that enabled her to express her position. While responding with agency, her fear of possible repercussions for activating a MET without going through medical staff may have constrained her response, in spite of knowing what was required. Carl (RN, Y0.6), who has less experience, appeared powerless to get a response:

> *… I just thought it was more interesting the doctor's reaction because I was really stressed. Like I felt really stressed. I had to actually tell myself to just kind of like chill for a minute and clear my head because I mean for me seeing a patient with the blood pressure in the 80s and it got to the 70s, that's scary. I mean to me it's scary. I was ringing the doctors constantly and then to me they didn't seem too concerned…. but anyway one of the doctors said that she didn't really know what else to do apart from give the fluids. She kind of just like stood there and I was like well. You're going to have to do something. I can't just leave him there…*

Although Carl eventually called a MET response, this took some time, and the degree of inexperience between Carl and the junior doctor impeded both parties' clinical decision-making. Slow responses to address patients' changed condition appear to be reinforced by inexperience.

Rose (RN, Y20) suggested that experience is important in how medical staff relate to nurses. This was seen in the observation phase at site 2 (the medical ward) when, at times, doctors and nurses were more relaxed with each other.

This was a result of doctors having spent periods of time on the ward, and of their knowing the experienced staff. On the surgical ward (site 1), doctors were often in the operating theatre, which added to nurses' difficulty in getting a patient review. Rose (RN, Y20), who works in a surgical ward, questioned the appropriateness of seeking assistance over the phone, raising the idea that visual assessment of the patient is particularly important:

> *… I guess it is a little bit of a worry If experienced nursing staff are looking after that patient and they're just told by the doctor don't worry. It is very hard sometimes when you're trying to get a doctor to review a patient over the phone. Sometimes you don't feel they listen or you know they might want to give a bolus dose or something over the phone when in fact they should be eye balling the patient or coming to see the patient …*

Rose was confirming the importance of visual cues in support of patient assessment and clinical judgement.

Despite experience and recognising the inherent problems of disregarding clinical judgement, the desire to conform with and not to challenge the system was clear, and this placed nurses in a vulnerable position. With experience and confidence, nurses were more prepared to act outside the ADDS to secure assistance for a patient earlier rather than wait for their vital signs to change. But not all nurses would do this:

> *… I would respect the system, the ADDS system, in caring for that patient. I wouldn't hesitate to do that, regardless of what my findings said … That's perhaps one of the downfalls of the system is that I don't know that people act above and beyond it when we ought to. It becomes, it serves a minimum and then it becomes the standard, which is a risk with systems I think…* (Andrew, RN, Y15).

Experience and clinical judgement, as described by the nurses, are interrelated, but agency appears to be proportionate to a nurse's years of experience. With experience comes confidence, which enhances agency. Nurses reported tension in the way that their decisions were enacted, particularly when expressing agency.

5.3.5 Vital signs: to act or not to act?

There appeared to be an overlay of cultural domination at play in whether a nurse felt that they could act to address an abnormal vital sign. As Sue (RN, Y20) cautioned: *'If I don't* [trigger an intervention] *and something happens then I'm not covered*'. The capacity to act also depends partly on organisational culture, in that:

> *…it's mandated that people call people now, which is a good thing. But I also think there's so much mandatedness of it, which is not even a word. But sometimes people don't think for themselves…* (Opal, RN, Y20).

This implies that agency is somehow confined by hospital and ward organisational and cultural practices that necessitate devolving responsibility to others.

Nurses work in a health professional team and appear to rely on that team to address issues with vital signs.

> *…it's very challenging when you're working in a team. So when the doctor says, "That's fine," you've got to have a fair bit of experience – I don't know whether, it's not experience, but understanding to then challenge that...*(Lucy, RN, Y20).

Lucy is referring to the need for nurses to possess not only experience but also understanding of the patient's physiology, to be able to challenge the doctor. Meg (RN, Y20) attempted to explain the conflicting role that medical staff play in the response to vital signs:

> *… I had a look at these observations and went – whoa, that's pretty bad then because this patient is actually in a fairly dangerous condition. So, they do get very target fixated on their speciality and I think this is also driven by the medical staff. I have taken cardiac observations, now obviously, I am a cardiac specialist, so I can see things that may not be nuance to somebody else, and I have taken that to the surgeons and the way they fixed it was to turn off the monitoring. Not my problem...* (Meg, RN, Y20).

By avoiding problems in this way, nurses found themselves in conflict with the goal of patient-centred care as balanced against a system dictating a particular response. Exposure to this 'not my problem' thinking downplays the significance of the issue that the nurse is conveying. This may result in desensitisation to abnormal findings, which, for the inexperienced nurse, could have a significant impact on safe patient care.

The capacity of nurses to work against the system was also based on experience, and on the desire to place the patient's condition at the forefront of care. For example, Tina (RN, Y20) advised that for her the practice of taking vital signs, and ultimately of challenging the 'status quo', is very much dictated by:

> *… the patient's condition, some answers might be the doctor's orders are that the obs be taken or the ward has a particular policy that means that the obs are taken at particular times. But the patient's condition is how I've taken obs …. So unless their obs were a concern of course, if they did have something that was delicate like their blood pressure or their pulse that we were watching carefully then obviously you're going to do them. But again my first principle in nursing is to deliver client-centred care and client-centred care is about the client themselves and about their needs. So rather than looking at complying with something that tells me I have to do these obs every two hours or every four hours or every six hours or every eight hours I might be doing them more frequently than that if need be. And I think it's important for nurses and for their practice and their skills particularly around their ability to identify problems that they be supported in delivery points in their care and working around the client rather than working to a particular policy or protocol ...*

Doctors, with their elevated status, appeared to culturally influence how nurses responded to vital signs. For example, Rose (RN, Y20) explained the influence the ward culture has for her as follows:

> *… I think power* [aligned to medical consultants] *brings some arrogance sometimes but the kids, the young interns they're fabulous, they're as frightened as we are ...*

The apparent dominance that medical culture has over nursing practice may lead to nurses feeling unable to express what should occur in response to changes in vital signs, despite nurses receiving explicit education on what actions should be taken. This, though, is perceived as non-specific to the reality of practice:

> *…When education is provided, how do we then apply that to a patient care situation? Because you might know that, but how do you challenge the medical staff on that particular piece of knowledge, like how can a blood pressure of 70 be okay? You know, because are we losing perfusion to kidneys, and you know, things like that, so how do we equip nurses, or the team in general…?* (Lucy, RN, Y20).

Despite obvious frustrations in communicating their concerns, nurses with confidence and experience were undivided in their attempts to draw together their knowledge of vital signs, and their understanding of the patient and their condition to secure a response to their concerns. This also informed how they could then convey this information to medical professionals:

> *… There was a situation a little while ago and one of my friends – it wasn't me – had a normal ADDS score, wanted something done because she could see that the patient was wrong, so in her clinical judgement she knew that this was wrong, but the medical staff picked up the ADDS chart and said no it's all right, the score is only two, go away. So, she called them and they'd score her two. So, that's where she was using her skills in what are these numbers and what is the condition of the patient, which really is what the observation is trying to tell you, and that I think is something which is not well done with observations in a lot of areas…* (Meg, RN, Y20).

Meg was referring to the nurse drawing upon her understanding of the patient and their condition alongside a gut feeling that something was wrong. As the vital signs had not changed, the ADDS did not support the nurse's actions.

Krystle (RN, Y15) reflected on her own capacity to act in the interests of the patient showing how experience of changes in a patient's condition is connected to this ability

> *…I do think that you do have to experience some things where you just think – you get the opportunity to reflect on what you could have done differently, or could you just have rung another doctor, because another doctor wasn't listening to you, and you learned to be more pro-active on the patient's behalf…* (Krystle, RN, Y15).

Acting in the interests of the patient in a culture perceived to be dominated by medicine, and within an organisational culture that values and endorses adherence to a number-driven protocol guiding vital sign practice, can be problematic:

> *… I can remember this anorexic girl my age, 27, skinniest thing, normally sat around a hundred systolic* [blood pressure], *that was just her normal – but we didn't panic when she got up to a hundred and fifty. We didn't worry about that. And we probably should've really, 'cos there was things going on that over the next few days kind of became apparent with her kidneys and what not. But we didn't, because it didn't score anything on the ADDS it was within that normal range on the ADDS, we didn't worry. Whereas we should have because it wasn't normal for that patient. Yeah but high blood pressure is bizarre. People just don't worry about it...* (Frank, RN, Y6).

Frank was drawing attention to the need to understand the patient in their entirety rather than relying exclusively upon a single vital sign parameter to guide care. His account also reinforced the challenges nurses have in communicating care with other health professionals.

Finally, Lucy (RN, Y20) summarised the issues nurses face with respect to trust between professional teams (nursing and medical):

> *…because sometimes it's challenging when you have a nurse that wants to follow a system and do what's required, and then you have perhaps another medical team that turns up .. then says, "You don't have to do that."… "We're in MET criteria."… "Oh you don't need to call the MET." .. when for this organisation they've said, "If you're in it* [MET}, *that's what*

you have to do." … We are the eyes, and I think that if we're doing good assessments and communicating well with the teams, then we need the teams then to trust …so that when they do get called, they're required to turn up. But we have different levels of all of that, so that's just human nature. I think we, as nurses… because we are there, and we are seeing what's happening and doing that assessment …

To summarise this sub-theme, vital signs play an integral role in identifying physiological deterioration, but they cannot be divorced from other cues, nor from clinical judgement. Nurses articulated their frustration at working in a system that demanded they rely only on numbers to guide their actions, but those with experience appeared to be using 'work-around' strategies to reduce the risks of this approach. Nurses' agency was also relevant to the challenges faced in communication between health care professionals.

5.4 Chapter summary

This chapter has brought to light participants' views and meanings about vital sign practices in the medical and surgical ward environment. The data presented a description of the customary practices as influenced by ward culture and how this relates to experience with vital signs and physiological deterioration. Also revealed in the participant responses is the role of individual and collective knowledge, which nurses ascribed to the practice of vital signs through their multiple interactions with others. The dilemmas nurses face when encountering vital signs that do not fit the accepted normal values, and their struggles to gain the attention of medical staff have also been raised, and are suggestive of lack of agency.

Nurses' agency in responding to vital signs was highlighted, as well as how their actions were influenced by ward culture and structural factors. Rituals and routines evident in nurses' behaviour were described, as were the ways

that time constraints and ward activities drove their nursing care. Technology was discussed raised by participants as both hindrance and help, including ways in which the physical layout of wards influenced their use of this technology and thus their responses to vital sign changes. Challenges that arose in participants' practice were discussed, as were organisational policies that supported or inhibited nurses' actions. Nurses' actions in the interests of their patients were clarified, and so were the ways in which physiological deterioration was addressed when it had been identified. Nurses' relationships with others on the ward, including with health care professionals, was found to be a likely influence on nurses' agency. The casualisation of the nursing staff on the hospital wards contributed to their missing cues of physiological change.

Participants identified the importance of experience in enabling patient-centred care, including the confidence that it engendered. This was balanced against factors that nurses identified as working against patient-centred care. Nurses also reported that specialist education and practice made it easier for them to act with confidence, regardless of cultural and customary practices. Also, experience of patient deterioration was considered important in acting effectively for the patient. Experience and agency enabled nurses to bypass cultural and structural barriers.

Chapter 6 A critical realist explanation of nurses' vital sign practices

> *… we know that it actually is important to get things right and to do the right thing, absolutely the right thing by your patient … I think this is important …*(Opal, RN, Y20).

Nurses' vital sign practices have been generated and influenced by structures and mechanisms in the complex socio-cultural world of nursing in acute care hospital wards. A critical realist explanation follows, addressing how vital sign practices contribute to cues of patient deterioration being overlooked in spite of organisational structures such as the ADDS or MET being in place. The socio-cultural context and structural factors which generate nurses' agency in relation to vital sign practices explain nurses' meaning-making. The findings highlight the fact that nurses are responding in two polarised ways, either patient-centred care (drawing on experience, specialisation, and confidence for patient advocacy), or ritual and routine (as influenced by culture, organisational structures and power dynamics with other professionals). The matter of nurses' agency underpins these findings. Some factors enhance nurses' agency to the benefit of the patient, and some diminish it, introducing the potential for opportunities to detect and respond to physiological changes being missed.

The two central findings of the present study, juxtaposed and contradictory, will be explained in this chapter by reference to the literature, as will the factors underpinning nurses' agency. By exploring the stratified ontology uncovering and explaining the generative mechanisms of nurses' agency, this thesis contributes to knowledge about missed patient deterioration, and to

the development of strategies to improve patient safety. Figure 7, below, provides a map of this thesis' main premise.

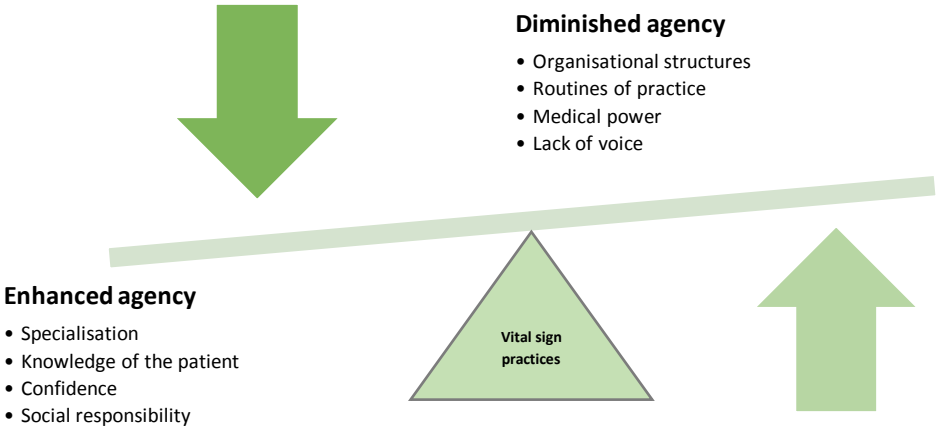

Figure 7 Agency of nurses in the context of vital sign practices

The findings reflect an inherent tension between nurses' focus on patients, with their individual needs, and the health care organisation, which mandates the response to vital sign deviations in the form of the activation of the adult deterioration detection system (ADDS) or the medical emergency team (MET). By mandating the same response for all patients, regardless of their actual health status, organisational safety measures such as the ADDS conflict with nurses' desire to individualise care. This makes the ADDS difficult for nurses to operationalise, and thus problematises its use. In the *real* stratum of reality, structures are contingent in the action of reflexive agents (Akram 2013), and it is this that will be explained in this chapter.

6.1 The structured reality of nurses vital sign practices

The interplay between social and cultural structures as experienced by nurses was present at many levels. The structural and cultural properties of the phenomenon of vital sign practices emerged through nurses' activities, which were generated across the stratified levels of reality. Nurses had the power or agency to make decisions about changes in vital signs, but these decisions were constrained by structural factors. Vital signs are firmly embedded in nursing practice, which involves a set of expectations about and constraints on their use. The generative mechanisms which were uncovered were a result of an interaction of conditions in the *real* world which influenced nurses' agency. Clinical practice provides the external, objective, situational and contextual factors which influence nurses' agency, as evidenced in the routines and cultural practices visible around vital sign measurement.

In Chapter Three, it was discussed that Archer (1995) divides structure into the twin realms of structure and culture, which Case (2015) sees as interconnected with agency (Case 2015). Archer (1995) also argues for analysing agency as a morphogenetic cycle, in that agents are understood as collectives and yet are also individuals and people with a personal and social life. The nurse, in this setting, has their own internal, subjective, concerns in relation to their personal nursing knowledge, theories and values, including their social realities and cultural practices. The actions undertaken, therefore, in vital sign practices, are produced by reflexive deliberations about the situation and about their own concerns, meaning that nurses make their choice of action in relation to their objective circumstances (Archer 2003), which includes the patient and their vital signs.

Nurses in acute care wards also have a cognitive, reflexive connection to socio-cultural relationships. In this way, rather than acting as solely

autonomous beings, they are interdependent, intermittently reflexive possessors of capacities that can only be practiced in joint actions (Burkitt 2016). For the nurses in the study, this means that while they are independently reflexive upon structures that define actions, they are also agents who have emerged from an 'emotional relatedness to others' (Burkitt 2016, p.322), whether this be to patients, colleagues or the organisation.

Interviews with participants both reveal unique conglomerations of causes as well as illustrate the human capacity for reflexivity (Bhaskar and Danermark 2006, Mooney 2016). Archer (2003) explains agents' personal capacity to define what they care about, exploring the notion of 'inner dialogue' or internal conversation with oneself to reflect upon social conditions in the light of current concerns. This exposes subjective reflexivity as a personal power, which entails synthesis of reflexive acts of self-knowledge. Reflexivity, therefore, is an important component of social agents, and it is this which shaped nurses' vital signs practice.

6.1.1 The reflexive agent

Human interaction takes place in a context that has been conditioned by the twin effects of structure and culture. Nurses reflected upon practice challenges that affected their agency. This is a process of recalling past events, and of using reflexive judgement to adapt responses to structures, taking past experience and personal capacity to act into account. Conditioning refers to the way in which practice offers contingent conditions under which constraints or enablements (Case 2015) generate the exercising of nurses' agency. In this way, self-knowledge (of social status, medical power dynamics and the consequences of inaction) informs nurses' agency.

Emirbayer and Mische (1998) suggest that agency comprises three distinct elements, namely: *iteration*, which is the selective reactivation of past patterns and thoughts of action; *projectivity*, which is the imagined possible trajectory of action in which structures of thought and action can be creatively reconfigured, and; *practical evaluation*, whereby the capacity to make practical and normative judgements from alternative possibilities is developed. The nurses used their reflective judgement to modify their responses to changes in the patient's condition, taking into account their past exposure to similar physiological signs as well as knowledge of the particular patient they were assessing, thus adjusting for context. On the basis of findings such as this, Emirbayer and Mische (1998) suggest that agency is the product of habit, imagination and judgement in both reproducing and transforming structures in an interactive response to a problem.

Nurses, as agents, are identified as reflexive beings with the personal or collective power to define a course of action (Archer 2007). Archer (2010, 2012) describes four different modes of reflexivity, *communicative*, *autonomous*, *meta-reflexivity* and *fractured reflexivity*, and argues that while agents may move between these modes, they tend to have a dominant mode. By virtue of this power, nurses were able to shape their socio-cultural context, becoming active agents through modes of reflexivity, rather than being, at all times, passive recipients. The nurses used reflexivity on their experiences both individually and collectively in order to inform their vital sign practices. The process of reflexivity enabled nurses to weigh up and prioritise their concerns about either the patient or competing ward practices, thus mediating between structural factors and agency. The outcome of reflexivity at times affected nurses' willingness to pay the price, as judged against self-knowledge and self-commitment to doing the right thing by the patient.

Archer (2010, 2012) defines *communicative reflexivity* as a process of affirming deliberated action before it is undertaken. The less experienced or confident nurses may use this mode of reflexivity to affirm their actions by talking vital signs and clinical decisions through with a more experienced nurse. Newly graduated nurses may be more likely to adopt this form of reflexivity, and therefore to be exposed to normative assumptions about vital sign practices. As a result, they are potentially vulnerable to social, cultural and power pressures to conform to the cultural routines of vital sign practices, even when these are harmful. Goodman (2017) suggests that this may result in nurses acting in a way that fits into the socio-cultural norms of practice.

Nurses conforming to the cultural 'norm' could explain the poor vital sign practices observed in the acute care wards and how those practices may contribute to missed cues of deterioration; through the socially constructed routine practice of nurses omitting the counting of respirations, for example. Odell's (2014) audit of nurses' vital sign practice provides similar accounts of non-compliance with expected standards in vital sign practices as are raised in the present study. Similarly, Ansell et al. (2014) reported that experienced nurses considered respiratory rates unimportant, a finding which was consistent across the three hospitals studied. Flenady et al. (2016) identified that nurses did not believe that collecting an accurate respiratory rate for all patients is a requirement, with nurses rationalising their behaviour by adjusting the significance of the organisational requirement. The communicative reflexively dominant nurse may be less likely to act to challenge the status quo around this missing vital sign, and will often take and perpetuate a position which may be sub-optimal in terms of quality vital sign practices.

The second element in Archer's (2010, 2012) theory of the internal conversation, *autonomous reflexivity*, is self-contained, and leads directly to action. This kind of reflexivity was seen to be within the scope of the more experienced nurse, particularly when they determined that a patient's condition did or did not warrant medical review, using their agency to adjust the expected ADDS response. This agency was at times constrained by structural factors such as medical power dynamics. The nurse with autonomous reflexivity may not need the validation of others to act, and though this could be viewed as the nurse with experience acting within their domain, it could also reflect a lack of consideration for others. It is in this area that the nurse is most likely to ignore 'rules' and to exert their own personal agency (Goodman 2017), which, being action driven, may or may not be in the best interests of the patient, reflecting the nurse acting for themselves. This again results in nonconforming behaviours, which could lead to poor vital sign practices.

Autonomous reflexive agents were more likely to perceive, negotiate, and adapt their responses to the ADDS system, which occurred in the context and micro-social climate of practice relationships in the clinical setting. When nurses with experience expressed knowledge gained from '*Knowing the patient*', '*Knowing the consequences*' and '*Knowing the culture*' in the context of structural factors, this enabled them to work around the rules (of the ADDS, for example). In this way, some nurses used agency to focus on the patient, and their experience provided short cuts. This approach to deviating from structures (such as the ADDS) is seen in the literature as a negative one. The words 'subversion' or 'deviance' are used, rather than accepting such acts as the nurses' implementation of clinical decision-making as a health professional in their own right. This reflects the power differentials between two health professions, namely medicine and nursing. Through this expression of agency, the nurse is seen as performing an act of 'responsible subversion' (Collins 2012), or a process of 'positive deviance' (Lindberg and

Clancy 2010), which, despite the negative connotations, is culturally accepted by the nurses. Thus, individual work-arounds may culturally reinforce poor vital sign practices as acceptable by nurses as collective agents.

Normalisation of deviance from rules and regulations generates acceptance of risk among nurses in the interest of efficiency and routine – when there is no evidence that this will harm the patient. The data showed that, in most situations, patient vital signs fell within 'normal parameters', even though there is uncertainty in the literature as to what these 'normal' values actually are (Ley, Salim et al. 2009, Hong, Earnest et al. 2013, Churpek, Yuen et al. 2015). Although education was provided on physiological deterioration, nurses may not have fully understood the impact of deterioration, and were thus willing to push the boundaries in the absence of evidence that the patient could be harmed. This means that the interpretation of vital signs by nurses was shaped by structures (the hospital ward, the medical condition or operative procedure, and by patients' age and health status) which generated their response. When vital signs changed, some nurses attempted to individualise care, presumably on the premise that their agency ought to supersede mindless adherence to the rules.

The third element of Archer's reflexivity theory, *meta-reflexivity,* is where internal conversations are critically reviewed against previous actions in similar circumstances, leading either to effective action or to inaction, depending on the result of the critique. Within the themes, '*They're ok/They're not ok*' and '*Knowing the patient*', alongside experience as a generative mechanism, this meta-reflexivity manifests itself in nurses avoiding calling for assistance when a vital sign parameter changed, as they used their personal agency to make a decision instead. This is similar to findings by Douw et al. (2015) on the development of tacit skills over time, with nurses often able to anticipate physiological decline without supporting

objective data from vital signs. This knowledge is difficult to communicate to others (Andrews and Waterman 2005, Odell, Victor et al. 2009, Chua, Mackey et al. 2013). Instead, meta-reflexives incorporate values derived over and above consideration of outcomes or consensus, as they draw upon thought before action, and consider whether this thinking is free from bias or cognitive errors. Archer (2010, 2012) considers a person with meta-reflexive skills to be one who may be more aware of power structures and ethical positions. Meta-reflexivity therefore draws upon contingent levels of experience, knowledge and vital sign practices as developed in socio-cultural contexts.

In terms of knowledge, power relations determine who learns what in society (Potter 2010), and knowledge in itself cannot be produced without some form of knowledge. The structural powers, in other words, objectively shape the situations which agents must then confront involuntarily, and possess generative powers of constraint and enablement. therefore, experience with patient deterioration is important in developing experience in socio-cultural context to address structural constraints. Potter (2010) argues that, with an underlying reality being the object of knowledge, there is a possibility of 'relatively true' knowledge not being socially certified as such; by extension, the converse would also be the case (p.151). The in-context knowledge that nurses possess is historically relative to the socio-cultural reproduction of power relations, but is not reducible to those power relations. This interconnects with nurses' behaviour as agents when reconceptualising their interdependent relationship to the ADDS, for example, within the constraints and, at times, enablements, of institutional and medical power dynamics. This may mean that meta-reflexives are more willing to operationalise the ADDS or MET and to challenge medical staff in order to achieve the right care for the patient, thus acting as an enabler of agency for the phenomenon of vital sign practices. Nurses' knowledge, however, may be viewed as of lesser importance than medical knowledge, which may reduce nurses' agency.

Archer's final mode is *fractured reflexivity*, whereby internal conversations result in action to avoid personal discomfort. This response may appear in the form of distress or avoidance strategies, both of which were evident when nurses spoke of acting to ensure that they were 'covering their backs' by activating the ADDS. This may explain why nurses continue to take routine vital sign measurements even when, in their opinion, the patient does not need them. This may be to account for structural factors, because routine forms a safety net to avoid criticism from other nurses, and to work within the constraints of organisational structures. Others have noted nurses' use of ritualistic vital sign practices (Evans, Hodgkinson et al. 2001, Zeitz 2005, Odell, Victor et al. 2009, Burchill, Anderson et al. 2015), which may be unrelated to the detection of patient complications.

Repeated exposure to challenging situations may build resilience, which enables the agent to act with confidence in the best interest of the patient. In this way, experience provides some nurses with the confidence to enact agency, whether this is constrained or enhanced, drawing upon developed resilience in order to buffer practice challenges and negotiate relational worlds (Braithwaite, Moore et al. 2014). Resilient action, as an expression of enhanced agency, is viewed in this thesis as a measure of confidence built up by repeated exposure to challenges faced in practice. This confidence was particularly linked to the complex pathways nurses navigated in order to secure an optimal response to changes in patients' health status. For example, in the context of other structural factors, where nurses needed to overcame medical power dynamics, experience empowered them to advocate for the patient.

Structural properties act at the level of the *real* to promote certain interactions and to constrain others. In this way, the nurses were significantly influenced by the medical professionals with whom they worked, which

generated experience for agency. Participants were fearful of a negative response from these medical professionals, and the research suggests that this is where problems arise within cultural and historical power relationships (Bell et al. 2014; Chiarella 2002; Falk et al. 2015; MacMillan 2012). Nurses were, because of their fear, less likely to expose themselves to external critique for their actions. The choice to activate (or not) the ADDS is an example of where nurses' agency is constrained through reflexivity. The lack of personal power over vital sign decision-making resulted in nurses feeling afraid of doing something wrong. This constrained them and contributed to their using work-arounds. Nurses reported difficulty communicating their concerns about patients' altered condition when those concerns were linked to prior experiences for fear of being 'told off'. When nurses had confidence, they were able to access assistance, whereas those who had had negative experiences were more likely to pass the problem on to someone else, thus acting to avoid personal distress. Addressing power dynamics is important as the literature draws clear associations between balanced interdisciplinary power relations and favourable patient outcomes (Van Bogaert et al. 2016).

The account of explaining nurses' vital sign practice meaning making is assisted by understanding modes of reflexivity as they occur through inner conversations. Embirbayer and Mische (1998) accounts of agency also provides a useful reference point to explain nurses vital sign meaning making as they accounted for clinical decision-making to transform structures. Socio-cultural structures are influential on every level of engagement, and events experienced by the nurse may be the culmination of numerous influences, not all of which are sensed or interpreted equally. Nurses, with their personal and collective agency, influence patient care on the basis of their understanding of patient illness trajectories, their assessment and interpretation of the patient's health status, and by their presence in the context of ward work, all of which is supported by in-practice experience and education. In this way, nurses' actions were seen as contextually contingent

and embedded within social structures. Social structures were imbued at every level of engagement, and events experienced by the nurse could have been the culmination of numerous influences, not all of which are equally balanced, sensed or interpreted (de Souza 2014).

Factors based on nurses' individual and personal reflection supported and, in some cases, constrained nurses' agency. In this way, personal reflexivity, a subjective mental activity in which past experiences and events are relived to clarify issues and situations (Archer 2007, pp.15–16), mediates between structure and agency (Sanghera 2017), with evaluative decisions enabling nurses to navigate their way through the complex health care setting in which they practice. Reflexivity was important to, and evident in, the way that the nurses described their practice experiences. Archer (2003, p.138) advises that:

> Constraints and enablers become activated with agents' own constellations of concerns as subjectively defined in relation to three orders of reality – nature, practice and society.

Reflexivity in context therefore played a fundamental role that revealed action to be a counter to structural forces following (non-) recognition of abnormal vital signs. This perspective takes into account how mechanisms differentiated experience from the more technical skill-based interventions, such as those of routine technology-mediated vital sign practices. Understanding the modes of nurses' reflexivity may help to address the complicated question of why health care workers miss signs of deterioration. The effect of the generative mechanisms of experience on nurses' decisions about vital signs is therefore contingent on their reflexive deliberations to creatively redesign institutional configurations such as the ADDS.

6.2 Experience as a generative mechanism

The concept of mechanisms implies that there are fairly regular but non-observable processes in the social world that have powers and liabilities able to produce outcomes. Generative mechanisms always work through people's actions (Blom and Moren 2011). Experience was a generative mechanism mediated by reflexivity on structures which either enhanced or diminished nurses' agency. Experience was used to make meaning of the patient's health status, but also to operationalise vital sign practices within structural factors.

Arbon (2004) argues that meaning-making is at the centre of the relationship between experience, the meanings that are derived from it, and the knowledge generated. Knowledge generation is a human activity, being socially produced, yet can also be created independently of humans (Archer et al. 1998). Knowledge of this kind is historically emergent, political and imperfect (Zachariadis, Scott et al. 2013). Nurses with experience, whether this be newly created or gathered over extended periods of time, are knowledgeable agents. Experience is developed in complex ways, and the knowledge gained is individual, personal and transferable across fields of practice. This relates to how nurses view themselves in the world, which is an important consideration for reflexivity about vital sign meaning-making and agency. It also relates to individuals' capacity to build personal resilience to weather the complex demands of nursing work, particularly when navigating difficult scenarios such as inability to action an appropriate ADDS response. This is an example of how personal resilience builds and sustains agency as mediated by the varied modes of reflexivity.

Among the most significant of vital sign practices which generated experience was exposure to a specialist area of nursing. Specialist nursing practice contributed to advanced assessment skills, which were developed from

working in a high acuity ward or critical care setting, empowering nurses to advocate for their patients. Exposure to an area where advanced assessment skills could be developed and applied as an agency enhancer is an important factor. The nurses in both acute medical and surgical wards were regularly exposed to patients with altered vital signs, but were using a limited range of assessment techniques, relying instead on technology to gather patient data, and avoiding hands-on assessment – also a common finding in the literature (Osbourne et al. 2015; Ansell et al. 2015). This finding is also supported in the work of Lavoie, Pepin et al. (2015), which argues for the importance of more advanced nursing skills being taught to ward nurses to promote recognition and response to alterations in vital signs. Contextual and practice-related factors therefore contributed to nurses' assessment behaviours. Constraints such as organisational structures, which limit opportunity to gain advanced assessment skills for patients with higher acuity, work to reproduce poor vital sign practices.

Nurses used their agency to problematise the ADDS structure and the rules that surround it in two ways: either experience produced positive outcomes to altered patient vital signs, or poor practice continued. Experience, as a generative mechanism, was, therefore, a product of the interactions with the independent structures and powers that socio-culturally existed at the level of the real. In this way, nurses' actions are contextually contingent on experience, and are embedded within social structures. Nurses generated knowledge of safe vital sign performance through continued nonlinear experience, and sustained this with education that built upon, and was contextually layered with, their past undergraduate and postgraduate education.

The importance of education has received attention, with Aiken et al. (2003) finding a correlation between education and rates of mortality and failure to

rescue (missed detection of deterioration), particularly in settings where patient acuity is high. Specialist education has the power to enhance nurses' agency (Cutler 2002) by providing a more detailed understanding of the relevant physiology, which adds to experience and thus to confidence to seek assistance to deliver patient-centred care. In this way, under some conditions (recognition of vital signs deviating from normal, patient looking unwell, etc.), patient-centred care was a key outcome when nurses felt or demonstrated agency with respect to vital signs. Experience, as a generative mechanism, provided nurses with the confidence to act on their clinical judgement about the best response to abnormal vital sign readings. This experience was gained in a variety of ways, including longevity on the ward, knowledge of the patient, preliminary education to become a nurse, additional education post registration or enrolment, and specialisation in a field that relies strongly on integrated assessment skills.

In the theme '*They're ok/They're not ok*', it was relevant that experience was developed through longevity on the ward, which not only builds experience of itself, but also exposes and/or cements working relationships, and clarifies and sustains the cultural expectations that are embedded in practice. This finding is similar to research undertaken by Odell et al. (2009) into nurses' role in patient deterioration. However, an integrative review of the literature on factors influencing ward nurses' recognition of and response to deterioration performed by Massey et al. (2016) did not identify experience as a factor in the recognition aspect of patient deterioration. The present study, however, confirms the importance of experience in generating agency.

Nurses' decisions were connected to the ADDS, but their agency was also mediated by a process of reflection on past experiences. Forethought as to imagined consequences of action is also linked to nurses' reflexive agency. When nurses used reflexivity to adjust their responses to patient care needs,

this resulted in their adapting to the structural and organisational context. Archer's (2010, 2012) modes of reflexivity attempted to go beyond a binary structure/agency explanation for action (Goodman 2017), which is useful in understanding the limits of agency or the effects of structure on nurses' decision-making.

6.2.1 Education enhancing agency

Nurses possessed knowledge to act on changes in vital signs, and to understand the implications if opportunities to act were missed. Education provides the rules and procedures that have the potential to influence nurses' actions. Despite education, nurses drew upon their reflexive experiences to overrule organisational requirements. Those with experience challenged traditional practices by changing which vital signs were measured and when. This form of agency appears to be both enhanced and subsumed by a more dominant factor: organisational culture.

Third party education was a means of disseminating organisational policies and procedures in order to assure compliance with the required response to vital signs outside the ADDS or MET thresholds. Kislov et al. (2017) see this as a positive thing, particularly if it is provided by someone with knowledge of the local culture, because it provides actionable ideas for practically applying the guidelines while taking the features of the specific ward into account. An unintended consequence of delegating vital sign education to others is that mobilisation of knowledge into action is highly contingent on the individual preferences and skills of the educator, who may not be aware of the complexities of the individual ward culture, and may neglect to address cultural differences in practice. As cultural practices are imbued at every level, nurses may not change their behaviour on the basis of education.

Also, aspects of preparatory education for vital sign practices may not be delivered in a hospital or similar health care setting, instead being delivered through simulations. This is particularly relevant to the recognition of and response to physiological deterioration. While some literature reports positive outcomes from simulation education (Buckley and Gordon 2011, Connell, Endacott et al. 2016, Rutherford - Hemming and Alfes 2017), unless this is linked to solid, real world examples reflecting cultural reality, or conducted in situ on a ward (Connell, Endacott et al. 2016), it may have a negative flow-on effect when nurses graduate and take up work in an acute care setting.

Few nurses recounted experiences attending simulated vital sign or deteriorating patient scenarios. This kind of instruction was available in the hospital, but not for the nurses at the time of the study. Medical staff in the organisation, however, were given priority to receive simulation education, with the rationale that they would be leading response actions for patient deterioration. This neglects the reality of collaborative patient care between professions as delivered in real-world settings. This may contribute to and sustain ambiguity in ADDS responses between the professions.

6.2.2 Experience and reflexivity

Patient care decisions were sometimes spoken of by the nurses in terms of being performed on the basis of a feeling or internal reaction which alerted them to something being wrong. This is similar to the element of *iteration*, which is the reactivation of past patterns and thoughts of action (Embayer and Mische 1998). Nurses found it difficult to articulate these feelings, and would sometimes use communicative reflexivity to seek clarification from other experienced nurses on the ward before alerting doctors to a problem. Herberg et al. (2001) defined intuitive feelings (or tacit knowledge) as an

instinctive belief about something which may or may not use conscious reasoning. Nurses develop tacit knowledge over time, and often anticipate physiological decline in a patient before any objective evidence is available (Douw, Schoonhoven et al. 2015).

Nurses' subjective assessment of a patient's physiological status at times resulted in nurses using agency to secure a medical review before vital signs had changed. These decisions to act were based on easier to articulate factors, such as colour changes, or that the patient did not look well. Other researchers have confirmed the presence of both forms of experience-related knowledge, in the form of tacit awareness, or of nurses' subjective assessment resulting in their seeking a medical review before the vital signs themselves had changed (Andrews and Waterman 2005, Odell, Victor et al. 2009, Flenady, Dwyer et al. 2016, Flenady, Dwyer et al. 2017). This form of agency reveals the way in which some nurses place more reliance on their subjective assessment or tacit awareness than on vital signs when faced with a feeling that something is wrong.

6.2.2.1 The influence of ADDS and the reflexive agent

The ADDS, as a structure, had the power to enhance or constrain nurses' agency as they resisted or circumvented structural impediments to secure a medical review. Nurses were willing to act above medical advice to seek assistance from higher levels of authority when their concerns for the patient were not addressed, overruling less experienced medical professionals, or, at times, even consultants who had the overall responsibility for care of the patient. In the data, this was seen at all levels of nursing experience, but in particular reinforced the authority of the less experienced nurses. Less experienced nurses were more likely to follow the prescription of the ADDS, and did not question the structural boundaries around their decision-making.

Less experienced nurses were more likely to use the ADDS as prescribed, as it provided them with an established language and pathway to communicate their concerns to doctors. This capacity to communicate physiological change to medical personnel did not rely on detailed assessment findings, which a less experienced nurse may not possess, as seeking assistance through the ADDS relies solely on a change in vital signs. Because of this, less experienced nurses expressed their support of the ADDS as a safeguard for patient care. In addition, nurses with less experience were reliant on more experienced nurses to support their actions, and the data showed that less experienced nurses conferred with other nurses as the first step in seeking assistance for their patients. This contrasted with the practice of more experienced nurses, who may activate an ADDS response independent of vital signs, without consulting anyone. In this way, nurses, regardless of experience, used subjective and non-quantifiable signs (such as change in colour) to recognise clinical deterioration. The literature supports the finding that nurses may seek assistance even before objective signs manifest (Chua, Mackey et al. 2013, Lavoie, Pepin et al. 2016). The ADDS, therefore, was perceived by nurses as enhancing their agency to seek assistance even before vital signs had changed.

Nurses use their reflexive mediated agency to renegotiate the meaning of vital signs, including their usefulness and purpose, to fit in with the time of day and patient needs. Practice conflicts arose when structures dictated an ADDS response which was incongruent with nurses' assessment of a patient's health status. Confidence to use agency is linked to repeated exposure to dynamic physiological changes in patients. This results in nurses who are regularly exposed to changes in vital signs being able to explain them as normal for someone with that patient's condition and health history. The ADDS, however, neglects the subjective nature of nursing work, instead privileging objective data.

Irrespective of the depth and scope of nursing practice, nurses were also selective in their measurement of vital signs, in opposition to structural requirements that a full set of vital signs be recorded. Nurses rationalised their selectiveness on the subjective data that the patient 'looks ok'. The resultant under-emphasis on respiration rate measurement is reflected in the literature (Odell, Victor et al. 2009, Flenady, Dwyer et al. 2016, Flenady, Dwyer et al. 2017, Flenady, Dwyer et al. 2017), yet it is incongruent with the nurses' stated belief in the importance of this vital sign as an early indicator of clinical decline. In poorly applying vital sign practices in this way, nurses were relegating individual vital signs to a position of lesser importance than their subjective assessment of patients in their care.

Agency gives nurses the confidence to make decisions in the best interests of the patient. Experience and knowledge of the patient led nurses to use patient-centred care to adjust for patient complexity when deciding a course of action, rather than relying solely on vital signs. Essentially, experience and reflexivity, as critical elements of agency, had the power, when activated, to facilitate or to constrain nurses' decisions when assessing patients' wellbeing, and as to the role vital signs ought to play. Experience that enhanced agency was built on a range of factors, namely education (whether this be experience in the profession or a postgraduate degree) and longevity on the ward, all of which were mediated by reflexivity. The way that nurses use vital signs appears to be very individual and patient-centred.

Nurses had the power or agency to make decisions and act upon changes in patients' condition, but this was always mediated by structural factors. Nurses with enhanced agency (generated through experience) were more likely to activate safety strategies for their patients through a process of reflexivity. Knowledge and experience alerted nurses to possible problems, and formed the basis for intuitive awareness of difficult-to-articulate

concerns before they appeared in vital signs. Experience, therefore, was a mediator between structure and agency, and gave more depth to reflexive deliberations about vital sign responses.

6.3 Vital sign practices in socio-cultural contexts

Nurses play a significant role in the detection of changes in a patient's condition by virtue of their uniquely constant interaction with patients, and through engagement with other health professionals. Value judgements about the patient's age, quality of life, and perceived seriousness of their illness rendered these variables 'social' (Mackintosh and Sandall 2016). Social processes and contexts are underpinned by the formation, exercise and causal efficiency of reflexivity, creating contexts and relationships (Caetano 2017). Socialisation, however, can further entrench poor vital sign practices (such as overly subjective interpretation) as the cultural 'norm'.

From a critical realist perspective, nurses' practice is shaped by the prevailing culture of the group, which provides them with a lens through which to interpret information and knowledge. This means that nurses are encultured with their own meanings of vital signs through structural conditioning and through the consequences of practice, both mediated through agential reflexivity. Nurses do not appear to be playing an active part in shaping the deteriorating patient agenda, and structures such as the ADDS produce practice conflict. This reflects a cultural morphostasis which has tendencies to reproduce the same (including poor) practices, which may contribute to deterioration being missed.

Social responsibility is underpinned by relationships, and it is within these that, under certain conditions, agency is enhanced or constrained. Relationships are important in that no one agent operates in a vacuum, and the nature of health care requires an interconnected approach in order for patient care to be made as safe as possible. This interconnectedness means that the act of nursing is not carried out in isolation from others as a solo performance. Rather it is enmeshed in a space that is also occupied by others. The most important relationship to nurses' agency was a sense of social responsibility to the patient. The literature review highlights the role of agency for safe, quality patient care, as demonstrated by integrating knowledge of the patient, of physiology, and of vital sign practices to inform patient advocacy and to take appropriate action (Cioffi 2000, Kenward and Hodgetts 2002, Minick and Harvey 2003).

Social explanations require an account of associations between actors, and, for this research, relationship interactions posed difficulties when agency was constrained. This was experienced by some nurses when communicating their patient concerns to doctors. This resulted in nurses avoiding conflict by not relying on changes in single vital signs. As the nurses attempted to exert agency they felt conflicted when going against organisational rules and values.

6.3.1 Cultural influences

Context was an important factor in nurses gaining experiences with the physiological changes that result in changes to vital signs. As experience is a personal attribute gathered throughout life, knowledge, particularly tacit knowledge, is 'bound to a person and is situation or context-orientated' (Herberg, Bussing et al. 2001, p.688). Context, in this thesis, is more than the ward on which a nurse worked and the length of time spent there; given that this is a critical realist study, the term encapsulates a range of additional factors. De Souza (2014, p.145) describes context as a microcosm of society, comprising 'not only the aspect of culture, but also the aspects of relations, structure and agency'.

Nurses are socialised to use vital signs according to how these are interpreted by individuals and by corporate agents. Socialisation includes the process by which students learn about the role and use of vital signs and how they are assimilated into practice. The nursing socialisation and acculturation process reinforces vital sign practices, as nurses experience some freedom to interpret vital signs and apply them in the given context. In this way, the practice culture supports and promotes the attitudes and patterns of behaviour which serve to maintain nurses' agency. Conforming to ward expectations reflects nurses' awareness of others beyond themselves (Kaba and Beran 2016) and how they themselves fit into this socio-cultural 'norm'. This behaviour is driven both from within socio-cultural structures and by individual agency (Braithwaite, Moore et al. 2014). Conforming to the social norms through prioritising patient washes, bed-making and adherence to routines exemplifies nurses' conforming behaviours. This however, may come at some cost to vital sign practices, and may result in missed cues of deterioration.

A culture that supports enhanced agency arises within organisational and hierarchical structures. On shifts where nurses had a good relationship with medical staff, and were also familiar with the regular routines of practice, their confidence to advocate for the patient was evident. Nurses discussed how much easier it was to get assistance for a patient under familiar conditions, including knowledge of who was on a shift that they could rely on. For staff sent to relieve a ward staffing shortage, the relationships were not as embedded. Reflexivity mediated adherence to cultural norms; for some, agency was constrained, and casualisation of staff in the workplace was the context in which this was most evident. Culture was therefore important in enhancing agency, as it imbued, shaped and filtered across everything a nurse did in their focus on patient-centred care.

For nurses to act on vital signs and on changes to a patient's physiological status in a context-sensitive manner, they must acknowledge social structures and relations. This means that, for enhanced agency, nurses must have the positional power or authority to act on behalf of their patients, they must understand the cultural practices which relate to their role, and they must acknowledge the factors connected to and informing their actions. The contexts of nurses' agency are dynamic rather than pre-determined, and they set the boundaries of nurses' action (de Souza 2014).

Nursing culture has been influenced over many years by a proliferation of educational approaches and professional and organisational regulatory policies. Mandatory education on physiological deterioration in hospitalised patients was in place in the organisation at the time of the study, but this did not appear to have changed cultural practices, as other structures superseded nurses' agency. Segregating the professions for the purposes of deteriorating patient education may reinforce hierarchical positions in health

care, and will not lead to improved communication between doctors and nurses. Without embedding experiential realism in shared education programs, it will be challenging to change social behaviour and organisational culture (Connell, Endacott et al. 2016).

6.3.2 Influential relationships

Socio-cultural relationships affected nurses' behaviours, and this effect was due to a number of factors. Nurses identified the importance of knowing the medical staff who were caring for a patient, and their availability. This is important because hospitals rotate medical staff through various specialties and wards, thus requiring that relationships be renegotiated on a regular basis. The observation data showed that nurses' agency to intervene in a patient's physiological decline was enhanced when early access to a medical response was available. This was particularly important on the surgical ward, where doctors could be tied up in the operating room throughout the day. On the medical ward, nurses spoke of possessing more knowledge than the doctors about patients' details because of the amount of time they spent with them, and this, they felt, empowered them to direct the relationship with the patient.

Other relationships which provided nurses with the confidence to act in the interests of the patient were those with their colleagues, which resulted in a sense of social responsibility to do the right thing by their team. The role of the Nurse Unit Manager is important in leadership, and in building a resilient team, because they are the go-between for internal policy directives and play a crucial role in the empowerment of nurses. Although Nurse Unit Managers were, in the main, absent from direct patient care, the nurses did not consider this absence important, as the team leader on the shift became the surrogate conduit between organisational governance, other health care

professionals, and oversight of quality care. Oversight of patient care by more experienced nurses in order to reduce harm has been raised in the literature (Cardona-Morrell, Prgomet et al. 2016), but has not been specifically connected to nurses' increased confidence to escalate care.

6.3.3 Resiliency in relationships

The interviews elicited narratives that connected events and behaviours over time, helping to explain the complex and contingent nature of causality, and thus capturing the participants' reflexivity. This revealed patterns of adaptability and of resilient action, which Hunter and Warren (2014) characterise as a positive, agency-enhancing response to a complex or adverse situation. In the study, this was shown in the way that nurses drew upon their experiences in navigating complex practice challenges. Complexity, here, refers to the collection of structural and cultural factors necessitating work-around strategies to secure optimal responses to concerns about changes in a patient's status. This complexity was particularly evident when nurses reported constraints imposed on their decision-making, even though they had, as they saw it, the foresight to resolve the issues.

Foresight – which aligns with Emirbayer and Mische's (1998) idea of *projectivity* – to prevent further deterioration was apparent in nurses proactively escalating their concerns to a higher authority when a response from medical staff defied expectations. This reflected nurses' learned resilience and confidence to act. The development of resilient action strategies correlates with experience of physiological deterioration, and of the appropriate actions to address it. With resilience, experienced nurses had the confidence to go outside the structured pathways of the ADDS to avert anticipated further problems from developing.

In adjusting their response to the ADDS, the signals most often used by nurses to make decisions tended to be harder-to-articulate patient cues, reflecting a process based on a continuum of experience, pattern recognition, and knowledge of the patient within recognised contexts (wards) and structures (patient conditions). Rather than relying on the ADDS or an individual abnormal vital sign to inform decision-making, nurses spoke of drawing upon their experiences, which were aligned to contextual, collectively constructed, internalised, and often well-rehearsed mind-maps of what could be done to address a problem. This is in keeping with Archer's realist social theory work, which addresses the interplay between social structure and agency (Archer 2003, 2007), and highlights the role that an individual's reflexivity plays in mediating the effects of social structure on their capacity to pursue purposive or intentional action.

Individual choice is a product of two constraints: the first is selecting from among the options available, and the second is the pressure to abide by social rules, which influence the individual's perception of these options' appropriateness and their order of preference (Cockerham 2005). The selection of which vital signs to measure appeared to rely on nurses' judgement or on how much time they had rather than on organisationally mandated frequencies, a matter also raised in the literature (Cardona-Morrell, Prgomet et al. 2016).

Dispositions to act are constructed through socialisation and experience, and an agents' place in a social structure providing the conditions for this process (Cockerham 2005). It should be noted, therefore, that structures such as social position in the hospital hierarchy influenced the social environment in which nurses gained experience. Archer (2003) advises that through this social and experiential interaction, reflexivity and the ability to perform as

agents evolve over time, and thus socialisation and experience give rise to agency. Reliance on a casualised workforce, as seen in the data, may mean that nurses do not develop socialisation, and therefore lack the experience needed to incorporate reflexivity into practice – this may add a piece to the puzzle of why opportunities to detect deterioration are missed. Further, structures either constrain or enable choices (agency), but agency is not passive, and instead requires something to constrain or enable it to become active choice (Archer 2003, p.4). Nurses, therefore, were deliberate in their actions with respect to taking vital signs on the basis of many factors.

6.3.4 Power dynamics

Critical realism uncovers the complexities that lie beneath observable practices, as well as clearer pictures of mechanisms in the context in which they occur. The data showed that influential relationships and culture, alongside professional hierarchies, affected how nurses worked with vital signs. Culture placed boundaries around nurses' agency, leading them to follow paths of least resistance. The effects of culture, relationships and organisational hierarchy affected the nurses' capacity to respond with autonomy to changes in patients' physiological health. Instead, medical authority remained dominant over the nurse, and this was a result of organisational structures.

In terms of additional cogent power dynamics, historical context and cultural identities were prominent in influencing nurses' vital sign agency. For power to exist, an exchange of some description needs to take place (Tumbat and Grayson 2016). Nurses willingly handed over care to doctors, but, when there was concern, nurses adopted work-arounds in order to advocate for their patients. This was apparent across the research data, regardless of context. Similar influences affecting ward nurses have been noted by other

researchers (Coombs 2004) exploring patient deterioration, including, for example organisational culture (Mackintosh and Sandall 2010, Nagus, Greenfield et al. 2010), gender (Mackintosh and Sandall 2010), leadership (Muls, Dougherty et al. 2015), professional hierarchies (Van Bogaert et al. 2016), technology (Ansell, Meyer et al. 2015), skill mix (Aiken, Clarke et al. 2003), and patient complexity (Massey, Aitken et al. 2008, Odell 2009). Nurses appeared powerless to respond to skill mix deficits, and to a lack of equipment that was fit for purpose, each of which had the potential to contribute to patient deterioration going undetected.

Hospitals are sites of the application of influence and power, and this includes competition for resources (Spehar, Frich et al. 2014). These forces also affect the roles that emerge from social structures, such as those of nurse and doctor. Roles, as cultural constructs, both facilitate and constrain access to resources. The higher the prestige of a role, the more effective its power becomes. As nurses have a traditionally lower level of prestige in a hospital setting (Spehar, Frich et al. 2014), it is more difficult for them to access resources. Nurses' agency is reduced insofar as their influence on the organisation to improve their working conditions is concerned – and these improvements may be as simple as accessing more devices with which to measure vital signs.

For example, nurses appeared powerless to influence the equipment budget, despite the importance of this equipment to taking vital signs, and of those measurements to patient safety. By having their agency constrained through hierarchical structures in this way, nurses, as responsible social agents trying to 'do the right thing' by their patients, are placed in a position of conflict. In terms of power dynamics, nurses faced competitive power relationships in which the dominance of others reduced their agency. An alternative model would see power being distributed and negotiable.

Nurses also identified that care is fragmented, mainly through divisions of labour, which results in lack of ownership of problems. This is not unusual in social settings, where care is devolved to different treating medical teams, each with their own cultures, hierarchies, and divisions of work. Fragmented care was most evident when ward staffing required casual replacements at times of shortage, with casuals finding it difficult to know the patients and ward routines. Also, fiscal management and provision of resources at ward level are at odds in the health system, which may in part be due to the lack of nurses' voices in the hospital hierarchy (Nagus, Greenfield et al. 2010). This reduced nurses' agency; they were bound by resource constraints, which was particularly evident during vital sign measurement when functioning devices were in short supply.

To further describe these power differentials, consider that nursing is carried out in a complex world occupied by a range of patients, each with their individual life story, and alongside health professionals immersed in a social space governed by rules and codes of practice, both hidden and overt, that place boundaries (real or imagined) around what it is a nurse does. The reality of nursing is that despite delivering the vast majority of direct patient care, the profession has traditionally been invisible in decision-making and ignored by policy-makers in health care. This is partly because health professionals share a complicated relationship, one that is influenced by social status, gender, power and perspectives (McKay and Narasimhan 2012), with lines of authority and accountability crossed and blurred (Chiarella and McInnes 2010). The inability of nurses to collectively influence change in vital sign practices demonstrates their social place in health care. The nurses' reflections on their past experiences affected their vital sign agency.

The ADDS detracted from nurses' agency by assigning responsibility for responding to abnormal vital signs to medical practitioners. This situates the

nurse in a position where their diagnostic skills become non-essential to patient care. Also, by removing clinical decision-making in this way, the nurse is forced to adopt a 'one size fits all' approach, which is against the objectives of patient-centred care. Power dynamics were also acknowledged by nurses as detracting from their vital sign agency. This was mainly reflected in the doctor–nurse relationship, which placed boundaries around how nurses could escalate their concerns about patients. In clinical wards, the juxtaposing of nurses and doctors with differing levels of expertise in the organisational structure of the ADDS did not guarantee effective collaboration. Additionally, communication in securing a response to nurses' calls for patient review was particularly challenging, despite the ADDS providing a structured process.

The ADDS, which requires escalation of care for patients through medical channels, is an expression of the higher status accorded to medicine as compared to nursing. This may be legitimate, in that doctors lay claim to oversight of the patient's medical care, but professional groups claim autonomy on the basis that their work is situated in exclusive expert knowledge, which limits others' claims to legitimacy in clinical decision-making (Van Bogaert, Peremans et al. 2016). This may partially explain the struggle nurses faced in communicating their concerns when a patient's vital signs had not changed, or even, indeed, if they had changed, when they would defend their decision not to act on the basis that the abnormality was part of the patient's illness trajectory. ADDS therefore diminishes nurses' agency. Experience acting as a generative mechanism could override this.

In addition, politics and other health care professions have an ongoing influence. This has resulted in power imbalances between professions, such as medical and nursing relationships, but this is not the only aspect to consider. As the nurses in the study spoke, there was a sense of the nurses themselves relinquishing power to others, which requires attention if change

is to be made and the voice of the nurse is to be heard in organisation-wide decision-making. Other researchers have found similar occurrences in power differentials between professionals (Nagus, Greenfield et al. 2010), and that problems with inter-professional communication are an influencing factor in the response to patient deterioration (Andrews and Waterman 2005). Much of this can be linked to professional boundaries, which have a strong effect on the way that health professionals relate to each other (Powell and Davies 2012), which in turn affects their communication, as well as their collaborative skills. What all of the analyses raised in the literature lack is a theoretical account of how these structures and processes influence the agency of nurses in their use of vital signs.

6.4 The morphostatic nature of vital sign practices

The scope of nursing practice continues to evolve in response to internal and external factors. As the literature has shown, nationally these factors include an ever-increasing demand for health care services driven by consumer expectations, rapid growth in health-related technologies, and increasing complexity in health status and life expectancy (AIHW 2016). The nursing profession has demonstrated the ability to evolve by taking on roles that were previously in the domain of medicine (Chiarella 2002), but vital sign practices, beyond the addition of technology and structures such as the ADDS, remain in a state of morphostasis (reproduction) rather than morphogenesis (transformation).

The morphostasis of vital sign practices, as they are constituted through the structural elements of the ADDS, power differentials and organisational processes, may give rise to new patterns of behaviour or superficial differences in the stratified world, with their own powers and potentials. As structures position agents who take on roles in organisations, the role of the

nurse is the sum of these components within a concomitant cultural domain. These agents in a morphostatic cycle are also reproduced or changed, as the case may be, through conditioning, interaction and a set of consequences. In other words, nurses act within predefined circumstances in the acute care ward, but structures (such as the ADDS or MET protocols as defined by the nurses in that ward) are the result of nurses' agency, being reproduced by the nurses and medical professionals. Social interaction occurs when nurses interact with the vital signs in practice, which are then sustained or reproduced by these interactions. If poor vital sign practices are accepted as the 'norm' for the ward, then these practices are reproduced. Newly graduated nurses entering this culture become encultured to these practices, because they know no different. Agency becomes conditioned, therefore, to reproduce rather than transform (morphogenesis over time).

6.4.1 The ADDS sustains morphostasis

The ADDS, despite being implemented to improve patient safety, was more often a barrier to responding to abnormal vital signs, and thus diminished nurses' agency. The ADDS imposed a structure which detracted from nurses' ability to make decisions, because it overrode nurses' clinical judgement and forced actions that may not have matched their assessments. In this way, the ADDS, can be seen as a structure that constrains nurses and thus turns the taking of vital signs into a form of social action. This supports the work of a number of authors who have described the way that algorithms, such as the ADDS, are designed for an average patient in an average hospital ward (Douw, Schoonhoven et al. 2015, Lavoie, Pepin et al. 2015, Mackintosh and Sandall 2016) – they do not account for patients with chronic health conditions compounding their acute illness (Mackintosh and Sandall 2016). This places nurses in a difficult position, as vital signs may sit outside the normal range prescribed by the ADDS, thus triggering a false positive alert, even if the patient's condition is considered stable by medical professionals.

This contributes to fractured reflexivity, where nurses avoid placing themselves 'in the firing line' for calling a doctor when they consider a patient to be 'ok'. At the other end of the spectrum, nurses also found that their concerns were ignored when they detected deterioration that was not indicated by abnormal vital sign readings. Nurses' clinical judgement is restricted in these circumstances, as they must weigh the risks of the patient's specific condition against the risk of inflating a medical response and being criticised for it.

The lack of nurses' voices reduced nurses' agency and power to question the status quo. This is in part due to the overarching dominance of medicine, to the ward structure, and to the lack of clinicians' voices in determining how ward activities occur. The passive role that nurses play in the ADDS or MET structures reflects the historical and structural influences that have contributed to these encultured power dynamics. This, too, may be due to the dominance of medicine in dictating rules as to how a nurse should act. Without agency, nurses were powerless to work against the structural influences that impinged upon their decision-making, and instead used work-arounds to place the patient at the centre of care.

Factors that enhanced nurses' agency were linked to their goal of delivering patient-centred care. Nurses' clinical judgement about patients' health status was privileged over structures such as the ADDS. Expressing agency in this way draws upon a holistic view of a patient, a whole-of-person perspective, which, in the view of the nurses in the study, a doctor, having spent much less time with the patient, may not possess. The ADDS response does not account for the nurse's tacit knowledge, and therefore nurses were reliant on a system which did not recognise their capacity to make decisions to act outside the ADDS. Socio-cultural contexts and power dynamics influence nurses' agency, which is either constrained or enhanced as mediated by

reflexivity. This section has offered insights into the generative mechanisms that enhance nurses' agency in every-day nursing performance, as well as a deepened understanding of how nurses cope with complexity, and the factors that enhance their resilience.

6.5 Chapter summary

This chapter addressed the research question of how nurses' agency is influenced with respect to the measurement of and response to vital sign changes. Critical realism was used to explore the interrelationship of people, structure and culture, and their combined effect on vital sign practices, as well as how the latter two enabled or constrained the agency of the nurses in the study. The agency of nurses in the context of authority structures situates culture beside nurses working around the rules. This is particularly relevant, as organisational governance in the research setting placed responsibility for detecting patient deterioration on those on the frontline of patient care – the nurses –, who then had to abrogate care and report to doctors. Doctors, however, are removed from hands-on assessment, and therefore the nurses' role is still important. This research shows that nurses' agency is constrained by organisational governance, and, importantly, by culture, which is multi-layered and complex.

Structural conditions such as culture, history and organisational processes detracted from nurses' agency. Structures, as mutually sustaining transposable rules or procedures that empower or constrain and reproduce social action (Sewell 1992), were powerful drivers in contouring individual behaviours along socially prescribed lines. In this study, agency accentuated the capacity of the individual to choose their behaviour regardless of structural influences (Cockerham 2005). Ontologically, these structures were interposed as distinct strata of reality (Archer 2003), one influencing the

other in that there were times when structure outweighed but did not negate agency, and other times when structure completely overwhelmed it.

Nurses were bound by mechanisms of control that shaped their actions, not only by organisational rules, but also by parallel professions, and by forces within nursing itself. This thesis argues that nursing takes place in social settings, and that social relations are founded upon shared objective interests and their effects in motivating action. These influences on action, however, arose both from within and without the agent (Archer 2010), mediated by their reflexivity. In this way, nurses' agency was affected as they struggled to fit patients, with all their individual complexity, within the set parameters of the ADDS, a system which predetermines action. Nurses' agency was constrained by culture, which, in the experience of the nurses, conflicted with the provision of individualised care. The nurses felt that they knew better about their patients than the medical staff, as they were able to draw upon contextual knowledge, including of patients' health history, and their own prior experience. This understanding was not, however, without conflict.

Through the investigation of how nurses take and use vital signs, the present study has generated valuable insights into the generative mechanisms of experience that enhance nurses' agency in everyday practice. It has also deepened understanding of how nurses cope with complexity, and of the factors that enhance reflexivity and resilience and thus enable agency. Nurses use foresight to intervene when patients' vital signs change in order to do the best that they can for those patients, thus promoting patient-centred care as an agential outcome.

Chapter 7 Concluding comments and recommendations

> Nurses serve their patients in the most important capacities. We know that they serve as our first line of communication when something goes wrong or when we are concerned about health
>
> Lois Capps

This study aimed to describe and explain acute care nurses' vital sign practices, and, explore how agency, structure and cultural factors influence these. The thesis responds to the global need to understand and explain nurses' actions to do with recognition and response to the deteriorating patient. The explanatory theories produced by this research add to the body of knowledge in relation to structural and generative factors underlying nurses' vital sign practice and how they may inform subsequent responses to physiological changes in acute care patients. The study has highlighted the complexity of the real world of nursing practice, and that nurses must navigate nursing culture and medical power differentials to place the patient at the centre of care.

A critical realist approach allowed nurses responses and behaviours in hospital wards to be explained as being generated by underlying structures and powers. Nurses' decision-making in addressing changes in patients' condition was contingent upon their practical evaluation, which in most instances resulted in the use of work-arounds. This was a necessary outcome of agency operating in the presence of experience. The data revealed a tension in the way that nurses understand and use vital signs. On the one hand, nurses use vital signs as a means of navigating power differentials between themselves and doctors. On the other hand, vital signs are accorded

a lower priority, easily delegated as nurses use other cues to inform their patient assessments. Agents' actions in this way reconstitute structures, and this affects future action.

The purpose of this chapter is to offer conclusions to explaining the vital sign practices of medical and surgical ward nurses, and to make recommendations on the basis of the research findings. By way of summarising the thesis, each of the research questions is addressed. The chapter draws upon the results from the observation and interview phases, and links to the theoretical discussion which resulted from the data analysis. The strengths and limitations of the research approach are also outlined, and suggestions for future studies made. Recommendations for clinical practice, education and further research are also included.

7.1 Addressing the research questions

In concluding this sequential qualitative study, it is timely to review its aims, which were '*to describe and explain acute care nurses vital sign practices, and, explore how agency, structure and cultural factors influence these'*. Through field observation and semi-structured interview, this was addressed by exploring how nurses use vital signs, and how nurses' agency was expressed or diminished in the context of the complex cultural setting in which practice took place. Importantly, the study identified structural factors that influenced the measurement and use of vital signs in complex health care environments.

Undertaking this research has confirmed the challenges that nurses face in caring for acutely ill patients. To date, research on ward nurses' practice in the detection of and response to acute changes that has utilised the

philosophical framework of critical realism is sparse. Critical realism underpinned the design of this research, and has affirmed the nature of nurses' work, providing the realism necessary in reporting the findings, within the domain of the *real*. The following section addresses each of the research questions.

Research question one: *What are nurses' vital sign practices within medical and surgical wards?*

Vital sign practices were mostly poor, despite education and ADDS. Technology replaced 'hands on' vital sign procurement which resulted in omission of pulse and respiratory checks in most instances. Vital signs were often delegated to others, to those who may not have known the patient, which reflects the value placed on these signs for nursing practice. Other nursing care procedures took priority over vital sign measurement when the patient was considered to be 'ok'.

Routine and ritual were factors that impeded nurses decision making around changes in vital signs. Scheduling of vital signs was a tradition in each research site, which on the one hand diminished agency, and, on the other, empowered nurses to take vital signs when they deemed them necessary. Additionally organisational structures did not appear designed to support care delivery through the provision of resources at ward level, this was demonstrated through the lack of functioning blood pressure cuffs and a sufficient supply of equipment to procure vital signs. On most days nurses wasted time seeking equipment to complete a set of vital signs.

When vital sign agency was enhanced through generated experience and agency mediated reflexivity, nurses were in a position to make independent

decisions about their patients' care, which may or may not have included measurement of their vital signs. Nurses used their specialist experience, knowledge and skills to decide on a course of action in response to changes in a patient's condition. When vital signs were neither taken nor responded to, this was a reflection of the value that nurses placed on changes to a single vital sign as they referred to other cues to inform their decision-making, thus drawing upon knowledge of the patient. At times, these decisions appeared to represent missed cues and lack of specialist knowledge or experience.

Research question two: ***How do organisational and structural factors influence nurses vital sign practices?***

Focusing on the role that nurse's play in the care of the patient revealed that busy wards, as well as a lack of resources to take vital signs, diminished agency. In the context of the medical and surgical wards, this study confirmed other accounts of competing demands and scarce resources, and reported heavy workloads and staff shortages (MacPhee, Dahinten et al. 2017), and frequent use of casual staff and varying skill mix (Endacott, Kidd et al. 2007). Each of which had the potential to contribute toward poor vital sign practice.

The actions nurses take following discovery of abnormal vital sign measurements are complex, and influenced by structural factors, including cultural, professional and organisational. Observation of nurses during field work, revealed that their understanding and use of vital signs are shaped by the social world in which they work. Structures which affected their agency were organisational, and these were often outside the nurses' capacity to change, despite reflexivity. During the interviews, the nurses discussed deteriorating patient policies and procedures such as the ADDS, which, on analysis, was found to be an organisational structure which impeded their decision-making and thus their agency. By enforcing a process wherein

experienced nurses must escalate changes in vital signs to doctors, regardless of the nurses' opinion, the ADDS competed with nurses' attempts to place patients at the centre of care. The result of this was that nurses used work-around, which may or may not have placed the patient at risk. On the other hand, the ADDS empowered the nurse, through their reflexivity, to act as agents when patient-centred care was at risk.

Nurses used reflexivity and drew upon their individual, cultural and social history as they navigated through a complex world. Their social and cultural history propagated knowledge and beliefs that influenced how they understood and actioned vital signs in the context of practice. Power differentials between doctors and nurses were apparent, reflecting the influences of educational, professional and hierarchical factors that dictated what a nurse must do. Experienced nurses abrogated vital signs as less important than other tasks, and therefore delegated their unique contributions to the wellbeing of the patient to others. This devolution of their own power as experienced professionals makes experience and clinical wisdom invisible in health care.

Focusing on an alert system such as ADDS overshadows the roles of responsibility and accountability in the day-to-day physiological changes seen and managed by ward nurses when the patient is deemed not to need an ADDS response. In ritualistically complying with the ADDS, nurses created unnecessary work when reporting single vital sign abnormalities when considered as 'They're ok/They're not ok', which explained exposure to critique by doctors. Such criticism would, in turn, drive nurses further from assessment and knowledge. The power differentials between health care professions maintain this structure in which nurses' agency is superseded by medicine.

Research question three: ***What cultural and structural factors impact on nurses' agency in vital sign practices?***

Organisational hierarchy, power dynamics and cultural factors all affected nurses' vital sign agency by imposing blurred lines of authority. Socially, rules and codes of practice bounded nurses' place in health care. Fear of doing wrong resulted in nurses avoiding external critique from doctors and hospital hierarchies – it was easier to conform. Nurses lacked positional power to openly challenge the ADDS, but when they felt concern for a patient, reflexivity played an essential role. As reflexive agents, nurses had the power to define courses of action that prioritised their concerns.

Ritual and routines reflected cultural practices that superseded organisational rules such as the ADDS. Culture and hospital hierarchies caused nurses to use work-arounds to deal with issues perceived to be more relevant to the patient. In this way, vital sign measurements were used as part of a strategy to negotiate with medical staff when nurses were concerned about a patient. The ADDS was a structural factor which enhanced agency when nurses found they could not otherwise articulate their concerns. This was as a result of nurses using subjective cues picked up on in light of past experiences and patient-specific knowledge. Subjective understanding was valued by nurses, as it drew upon tacit understanding of patients' illness trajectories and was privileged over vital signs themselves. Reflexivity, experience and prior exposure to vital sign changes that nurses had seen to precede patient deterioration were considered important by the participants. This, however, could create tension, as nurses' capacity to exert authority was hindered if resilient action had not been built upon, resulting in nurses avoiding calling for assistance.

Also, ritual and routine reflected cultural practices that superseded organisational rules such as the ADDS system. Culture and hospital hierarchies generated a process of work-around by nurses to deal with issues perceived as more relevant to the patient. In this way, vital sign measurements were used as a strategy to negotiate with medical staff when nurses were concerned about a patient.

Prioritisation of vital signs was a result of reflexivity, generated experience which resulted in a willingness to act. Confidence was an important mediator of agency, but this was a product of individual, personal, reflexive and cultural factors. Education was another structure that affected vital sign agency, and which assisted in building and sustaining resilience. This promoted self-confidence to act in the interests of the patient.

7.2 A critical realist explanatory theory of nurses' vital sign practices

Experience was a power that nurses used to adapt and individualise care in response to patient complexity. Critical realism was suited to the identification of structural mechanisms that explained nurses' relationship to vital signs in the context of their daily practice. The stratified ontology of critical realism allowed for a much broader approach to the issue of recognition of and response to physiological changes in patients' conditions. The *real* world was seen to contain nurses' common sense entities for addressing vital signs, activated by generative mechanisms of experience in a stratified social structure. Gaining insight into the problem through observation and interview provided a window onto the subliminal cultural, hierarchical and power differential influences on nurses' vital sign practices. One of the tenets of critical realism is that understanding is dependent upon the context within which the area under study is viewed, to this end, consultation on data interpretation was undertaken at various points with

health care personnel from differing professional backgrounds to ensure the data's trustworthiness.

Reflexivity, structures and mechanisms such as the ADDS or the MET, resource availability to undertake vital sign measurement, and power differentials both enabled and constrained nurses agency. A critical realist approach provided meaningful insight into the push/pull tension nurses face as they attempt to situate the patient at the centre of care.

7.3 Strengths and limitations of the study

This research demonstrated how a qualitative approach using observation and interview can explore a complex clinical problem in the real world settings of medical and surgical wards. The critical realist lens helped to identify structural factors which may have remained hidden using alternative research methods. This study contributes to existing knowledge and understanding of patient deterioration in complex health care settings. In particular, analysis of the ADDS, as a barrier and enabler to nursing vital sign practice, offers new insight into how such systems may affect patient outcomes.

A strength of the research approach was that it embedded its first phase in a clinical practice setting using ethnographic methods, as this provided a frame upon which to reveal vital sign practices as conducted in a natural setting. Nurses at the bedside were the most likely to use vital signs, and it was they who were the most appropriate to observe in order to ensure the accurate identification and representation of the structural factors revealed to the researcher. To ensure participant anonymity, data was de-identified for its reporting in the thesis. The number of wards and hours of observation were

small, but the data captured were sufficient to tease out generative mechanisms of experience. The data are not generalisable, but the critical realist theory used is.

A limitation of undertaking research in the clinical environment is that the hospital wards were busy, which may have limited the availability of participants. It was not possible to seek individual consent from all staff the researcher came into contact with during the observations of ward activity, and therefore posters explaining the purpose of the study and the researcher's presence were displayed in the affected areas. Verbal consent was obtained from staff involved when the researcher attended ward rounds, at bedside hand-overs of care, or when nurses were attending to patient care.

Observing nurses provided a sense of the routines of ward work, highlighting the connections of vital sign practices to factors such as staff and technology. Although undertaking field work is not without its theoretical problems – in that those observed may change their behaviours due to the presence of the researcher –, it was clear that this was not an impediment to the study, as nurses quickly accepted the researcher's presence on both wards, and willingly gave their time. The researcher's participation in simple tasks such as bed-making built an easy rapport with participants, and, in the view of the research team, did not threaten the validity of the findings.

Interviews increased the study's veracity by elaborating on concepts identified in the observation phase. Interview questions were designed to explore and report the experiences of participants, and the meanings they attributed to them (Tong, Sainsbury et al. 2007), to elicit an explanation of structural factors which either enhanced or impeded agency. To overcome

barriers and add strength to free-flowing conversation, the questions were reordered to facilitate the addition of new factors by the participant. The interviews were conducted in a convenient location for the participants, which, though away from direct patient care, may have resulted in interruptions which could have distracted from and limited their responses. Additionally, some participants were busy and appeared tired, which may have borne on the depth and quality of their responses. Refreshments were made available to establish and sustain a relaxed atmosphere, and this helped with rapport and distraction from ward events.

A PhD is a journey in which changes of context are to be expected. Part-way through the data collection, there was a change in hospital policy in the form of the implementation of the ADDS. A benefit of this was that it provided an opportunity to record nurses' views and behaviours based with regard to the new policy.

7.4 Recommendations for clinical practice, education and further research

1. Designated areas for acutely ill patients

This study has highlighted how experience is a generative mechanism for nurses' to respond appropriately to the deteriorating patient. Segregating sicker patients into their own high acuit area in hospital wards, and assigning experienced nurses to care for them, could potentially expand the pool of nurses who are clinically able to detect and respond to physiological changes in their patients. Given the shortage of high dependency beds, and a projected increased need for intensive care beds (Joynt and Gomersall 2006), short term high acuity beds in wards may reduce pressure on critical care services assigned to respond to ward based patient deterioration.

Reconfiguring hospital wards to include designated areas for sicker patients will facilitate access to skilled nursing care.

2. Providing contextually rich education

Contextually delivered education should occur with interdisciplinary health care teams, rather than with individual professions. Education should be available to all nurses rather than a select few. This education should then be reinforced with in situ (on the ward) simulations that reflect the reality and complexity of deteriorating patient situations that are specific to each ward.. The majority of participants in this study attended generic instruction on deteriorating patient care through mandatory hospital based training. Addressing physiological changes specific to the ward through more detailed vital sign analysis, may assist in increasing knowledge of patient deterioration, improving nurses' vital sign practices and their agency. This would fit well with the recommendations of the ACSQHC on educating and training clinicians in the essential skills for recognising and responding to clinical deterioration.

3. Formalising clinical leadership in hospital wards

Nurse leadership on vital sign practices is needed. A nurse leader who can present ward specific data to ward staff on the outcome of missed deterioration could help to improve nursing care and increase the visibility of vital sign practice outcomes. Clinical leadership is important for supporting nurses in their decision-making. Nurse leaders can act as a conduit between hierarchical structures, but such leaders are often absent from direct ward practices. Consideration of how the nurse leader role is structured may contribute not only to the delivery of care, but also to the way care is communicated about between health care professionals.

Clinical leadership may also address the composition of ward staffing to reduce the reliance on casual nurses to fill gaps in the ward roster.

4. Redesign the medical emergency response system

Nurses are more likely to refer to nurses in the first instance when faced with situations that require attention. Ward nurse access to a nurse-led response system comprising the critical care nursing staff, may facilitate more informed and timely care for the deteriorating patient. This may avoid the power dynamics that were uncovered in the study and provide nurses with greater clarity in the 'worried' criteria of the ADDS/MET system.

In summary, further research is necessary in clinical practice to fully explore the relationship nurses have with medical staff with a view to increasing nurses' vital sign agency. Despite health care agencies incorporating 'nurse concern' into the MET system, this is still an under-researched area. Nurses' calls on the basis of concern are a missed opportunity to work with medical professionals on how tacit understanding of changes in a patient's condition can be acted upon before vital sign changes occur. This would support research work in recognising early signs of deterioration. Empowering nurses so that they have a voice in the development of strategies to address patient deterioration, and attending to inter-professional education may help to address this complex problem.

The driving aims behind this research were to improve patient care and to ensure that nurses have access to the right knowledge and skills to safely care for patients whose condition is changing. With the increased interest and investment by health care organisations and hospital accrediting bodies in

patient safety and quality of care, it seemed that the focus was disproportionately on what nurses and doctors were failing to do in hospital wards rather than on improving collaborative care and on reducing power differentials. This research has highlighted good areas of nursing practice as well as areas where improvements could be made. This study has also highlighted factors which contribute to significant power imbalances between the health care professions, which both diminish and enhance nurses' agency. Further research and practice improvements that can work to address this at a local level should be undertaken in the hope of improving patient outcomes. Theoretical insights generated by this thesis require additional studies to test their application, and to tease out and further explain generative mechanisms.

7.5 Conclusion

It is clear that structures and generative mechanisms that enhance or constrain nurses' agency with regard to vital signs have been explained in keeping with a critical realist framework of explanatory theory. The influences on nurses' use of vital signs as they navigated complexity and manoeuvred through power differentials have been explored, and an emerging theory of patient-centred care underpinning nurses' assessment of the physiological status of a patient whose condition has changed has emerged. The findings highlight tensions in the way that nurses engage with vital signs, and with how they are problematised in the context of busy ward work.

The literature review highlighted systems that have been implemented to address physiological deterioration, naming specific vital sign measurements as the triggers to activate an ADDS or MET response. The fallibility of individual vital signs was also highlighted, as was the fact that nurses also use other means of assessing a patient. Systems for communicating vital signs

were presented, and the problems nurses experienced when calling for assistance were raised. Organisational structures were identified, as well as how they might relate to decision-making.

Observation and interviews were the methods of research, and the ethical constraints placed on these processes, as well as the role of the research journal in ensuring ethical conduct, have been described. Data abstraction and retroduction generated the research themes, reflecting a critical realist approach to data analysis. Themes identified in each phase of the study, exposed the tension that nurses face as they used their reflexivity to navigate complexity in providing patient-centred care.

In addressing the research questions, the researcher's recommendations for future practice have drawn attention to the education of nurses, highlighting the importance of leadership support in order to help nurses to find ways to engage in working with other health professionals as agents in their own right. Redesigning wards to locate sicker patients into high acuity areas on the ward, and addressing staffing profiles to reduce the reliance on casual staff are also recommended. The strengths and limitations of this study have been presented alongside areas for improvement.

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Appendices

School of Nursing and Midwifery
Private Bag 135
Hobart
Tasmania, 7001
melanie.greenwood@utas.edu.au

20 January 2010

Ms Susan Price
Executive Director of Nursing
xxx

Dear Ms Price

I am a PhD candidate at the School of Nursing & Midwifery, University of Tasmania. My supervisors are Professor Mary FitzGerald and Professor Rosalind Bull. My area of research explores links nurses make between vital signs and subsequent actions, hoping to develop a substantial body of knowledge that will inform the safety and quality in health care agenda. I am corresponding seeking written permission to use surgical and medical wards as research sites to gather data.

My research will be informed by observing nurses in practice as they take and record vital signs, I would also like to ask questions of the nurses as to their understanding around vital signs and how that informs their actions. This will require me, with permission and ethics approval, to have access to nurses as they are engaged in clinical practice during day, evening or night duty. My role will be one of observer and it is not my intention to interfere with any duties that are performed in a nurse's day to day role.

My study will be submitted for ethics clearance through the HREC and will have full ethics clearance prior to commencing data collection. I will therefore undertake my research within a strong ethical framework ensuring informed consent is obtained from participating nurses prior to undertaking the observation phase of the study. Further, I will observe any HREC instructions for informing patients about my presence prior to entering any patient care area. No nurse will be placed in a position of risk by taking part in the research.

The wards I am seeking permission to access are 1B, 2B, 2DS, GSU and SSU for a period of four months over varying hours of duty. Once permission is received I would approach the areas to gain their agreement to support the study. I will conduct meetings with staff prior to the research project commencing to inform them of the process. Data collection will involve approximately twelve hours per week of observation resulting in field notes which will be kept secure at all times and located within the School of Nursing and Midwifery abiding by confidentiality agreements.

I would be very happy to share my findings when the project is completed with the permission of my supervisors. I will advise you when ethics approval is received and when the research will commence. To assist with the ethics process, I look forward to receiving in writing at your earliest convenience a positive response to my request. Correspondence or queries can be directed to me at the above address.

Yours sincerely

Melanie Greenwood

Email to Nurse Managers

Dear Nurse Manager (name to be inserted)

I am writing to invite staff in your ward to participate in a research project that looks at vital signs and nursing practice. This study is being undertaken for the degree of Doctor of Philosophy at the University of Tasmania. I will be undertaking the research under the supervision of Associate Professor Rosalind Bull, from the School of Nursing and Midwifery and Professor Mary FitzGerald.

The project involves observing nurses who have consented as they take and record vital signs. I will not interfere with work practices; however I may need to ask questions of the nurse from time to time to clarify my understanding of what I see. Patient information will not be collected, and I will request that the nurse ask the patient if I can enter the room to watch. If a patient refuses my presence, I will leave the room immediately. Ethics approval to undertake the research has been submitted (H0011031) and Ms Susan Price has agreed to my presence on the clinical wards.

Thank you for your time and considering the request for access to nurses in your ward. If you respond in the affirmative, I will make a time to meet with you to discuss the detail of the observation process and the method I will use to communicate the research project to the nurses.

Kind regards
Melanie

Melanie Greenwood
PhD candidate

Vital Signs Research

Would you like to help?

Would you like to find out more?

Information sessions held at ward handover times

Contact Melanie Greenwood, School of Health Sciences

Phone: 6226 4732 or email melanie.greenwood@utas.edu.au

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School of Health Sciences

H0011031 **Participant information Sheet (observation)**

PARTICIPANT INFORMATION SHEET

STUDY TITLE

Professional Monitoring of Vital Signs

Invitation

You are invited to participate in a research study into vital signs and nursing practice. The study is being conducted by Melanie Greenwood as a fulfillment of a Doctor of Philosophy degree. Co-researchers are:

- Associate Professor Christine Stirling, School of Health Sciences, University of Tasmania
- Professor Rosalind Bull, Associate Head, Teaching and Learning, School of Medicine, University of Tasmania
- Professor Mary FitzGerald, Professor of Nursing and Practice Development, xxx.

1. 'What is the purpose of this study?'

The purpose is to investigate vital signs and nursing practice.

2. 'Why have I been invited to participate in this study?'

You are eligible to participate in this study because your role in the taking and recording of vital signs is recognised as important in acute care settings.

4. 'What does this study involve?'

The study involves a researcher (Melanie Greenwood) observing you take and record vital signs whilst you are working on the ward. Melanie may ask you questions from time to time to help understand what has been seen. Prior to her entering the bed space, Melanie will ask you to gain permission from the patient. Should a patient refuse, Melanie will not observe this particular episode.

It is important that you understand that your involvement is this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate, and this will not affect your

relationship with the School of Nursing and Midwifery or your employer. If you decide to discontinue participation at any time, you may do so without providing an explanation. All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. All of the research will be kept in a locked cabinet in the office of Melanie Greenwood.

5. Are there any possible benefits from participation in this study?

It is possible that you will notice greater awareness of nursing practices and procedures from the project after a certain period of time.

The result of the project may be valuable information for others and it may lead to establishment of processes that improve recognition and responses to patient deterioration.

6. Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study. However, if you find that you are becoming distressed the observation will be stopped. If you believe it is necessary, you will be advised to receive support from the hospital counsellor or alternatively, we will arrange for you to see a counsellor at no expense to you.

7. What if I have questions about this research?

If you would like to discuss any aspect of this study please feel free to contact Melanie Greenwood on (03) 6226 4732 or Professor Rosalind Bull on (03) 6324 3423. Either of us would be happy to discuss any aspect of the research with you. Once we have analysed the information we will make available for you a summary of our findings. You are welcome to contact us at that time to discuss any issue relating to the research study.

This study has been approved by the Tasmanian Health and Medical Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study should contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. You will need to quote H0011031.

Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

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School of Health Sciences

H0011031 **CONSENT FORM Observation**

Title of Project: Professional Monitoring of Vital Signs

1. I have read and understood the 'Information Sheet' for this project.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study is looking at vital signs and nursing practice. The project involves Melanie Greenwood observing me take vital signs, which may involve me answering questions that will help understand my actions. The observation will occur intermittently over a normal working shift and will not interfere with my usual nursing practice.
4. I understand that participation involves the risk that I may feel slightly uncomfortable with Melanie's presence and that I can ask her to leave if I wish.
5. I understand that all research data will be securely stored on the University of Tasmania premises for five years, and will then be destroyed.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered from me for the study may be published provided that I cannot be identified as a participant.
8. I understand that the researchers will maintain my identity confidential and that any information I supply to the researcher will be used only for the purposes of the research.
9. I agree to participate in this investigation and understand that I may withdraw at any time without any effect, and if I so wish, may request that any data I have supplied to date be withdrawn from the research.

Name of Participant:

Signature: Date:

Statement by Investigator

☐ I have explained the project & the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation

Name of Investigator: Melanie Greenwood

Signature of Investigator: _____ Date: _____

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School of Health Sciences

PARTICIPANT INFORMATION SHEET

STUDY TITLE

Professional Monitoring of Vital Signs

Invitation

You are invited to participate in a research study into vital signs and nursing practice. The study is being conducted by Melanie Greenwood as a fulfillment of a Doctor of Philosophy degree. Co-researchers are:
Associate Professor Christine Stirling, School of Health Sciences
Professor Rosalind Bull, Associate Head, Teaching and Learning, School of Medicine, University of Tasmania
Professor Mary FitzGerald, Professor of Nursing and Practice Development, xxx

2. 'What is the purpose of this study?'

The purpose is to investigate vital signs and nursing practice.

2. 'Why have I been invited to participate in this study?'

You have been invited to participate in this study because you have been identified as an experienced nurse who may be better able to explain what has been observed in the taking and recording of vital signs in acute care settings.

4. 'What does this study involve?'

You are invited to participate in a semi structured interview on what has been observed during the taking and recording of vital signs. This interview will be a maximum of one hour in length, at a location which suits you. The interview will be recorded.

It is important that you understand that your involvement is this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate, and this will not affect your relationship with the School of Health Sciences. If you decide to discontinue participation at any time, you may do so without providing an explanation. All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. All of the research will be kept in a locked cabinet in the office of Melanie Greenwood.

5. Are there any possible benefits from participation in this study?
It is possible that you will notice greater awareness of nursing practices and procedures from the project after a certain period of time. The result of the project may be valuable information for others and it may lead to establishment of processes that improve recognition and responses to patient deterioration.

6. Are there any possible risks from participation in this study?

There are no specific risks anticipated with participation in this study. However, if you find that you are becoming distressed, the interview will be stopped. If you feel it is necessary, you will be advised to receive support from the hospital counsellor or alternatively, we will arrange for you to see a counsellor at no expense to you.

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Thank you for taking the time to consider this study.

If you wish to take part in it, please sign the attached consent form.

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School of Health Sciences

H0011031 **Consent form Interview**

CONSENT FORM

Title of Project: Professional Monitoring of Vital Signs

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1. I have read and understood the 'Information Sheet' for this project.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study is looking at vital signs and nursing practice. The project involves an interview with Melanie Greenwood at a place of my choice.
4. I understand that participation involves the risk that I may feel slightly uncomfortable with the interview and that I can ask her to stop the session.
5. I understand that all research data will be securely stored on the University of Tasmania premises for five years, and will then be destroyed.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered from me for the study may be published provided that I cannot be identified as a participant.
8. I understand that the researchers will maintain my identity confidential and that any information I supply to the researcher will be used only for the purposes of the research.
9. I agree to participate in this investigation and understand that I may withdraw at any time without any effect, and if I so wish, may request that any data I have supplied to date be withdrawn from the research.

Name of Participant:

Signature: Date:

Statement by Investigator

☐ I have explained the project & the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation

Name of Investigator: Melanie Greenwood

Signature of Investigator: _____ Date: _____

Interview questions

Section A **Introduction of the interviewer and project and participant demographics**			
	Section B Main question	**Follow up question**	**Probing question**
1	To help me understand a little about you and your interaction with vital signs can you tell me about the last time you were concerned about a patient's vital signs?		
2	What do you think drives the need for taking vital signs and the time between taking them?		
3	Has your understanding about the use of vital signs changed since you were first taught them?	What has changed?	
4	When you discuss vital signs with a colleague what type of things do you talk about? What would lead you to discuss vital signs?		
5	Can you provide an example where vital signs have made a difference to patient care?	What was it about the use of vital signs that made this difference?	
6	During my observation on the ward I rarely saw respirations taken. Why do you think that this is the case?		
7	Do you think that medical staff and nursing staff consider vital signs in the same way?		
8	Have you encountered any situations where vital signs have been misunderstood or misinterpreted?	What category of staff were involved	Why do you believe this happened?
9	What would make you think that an abnormal blood pressure reading is a concern?		

10	What other things about a patient do you look for to help you decide that they are ok?
11	How safe do you think it is to delegate (or be delegated) vital signs?
12	Have you ever had a situation where the person was deteriorating and you were not alerted? Can you tell me about it?
13	Have you ever had a situation where you did not alert someone when a person had changes in vital signs? Can you tell me about it?
14	Ultimately who do you feel is responsible for vital signs?
15	Is there anything you would like to add which will help me understand how nurses interact with vital signs?

Participant Demographics **ID number** **Ward Med** **Surg**

Identified gender Male Female Transgender

How long have you been working as a nurse? Registered Enrolled

20+ years

15 – 19 years

10 – 14 years

5 – 9 years

1 – 4 years

New graduate

How long have you worked on this ward?

20+ years

15 – 19 years

10 – 14 years

5 – 9 years

1 – 4 years

New graduate

Do you have postgraduate qualifications? Yes No